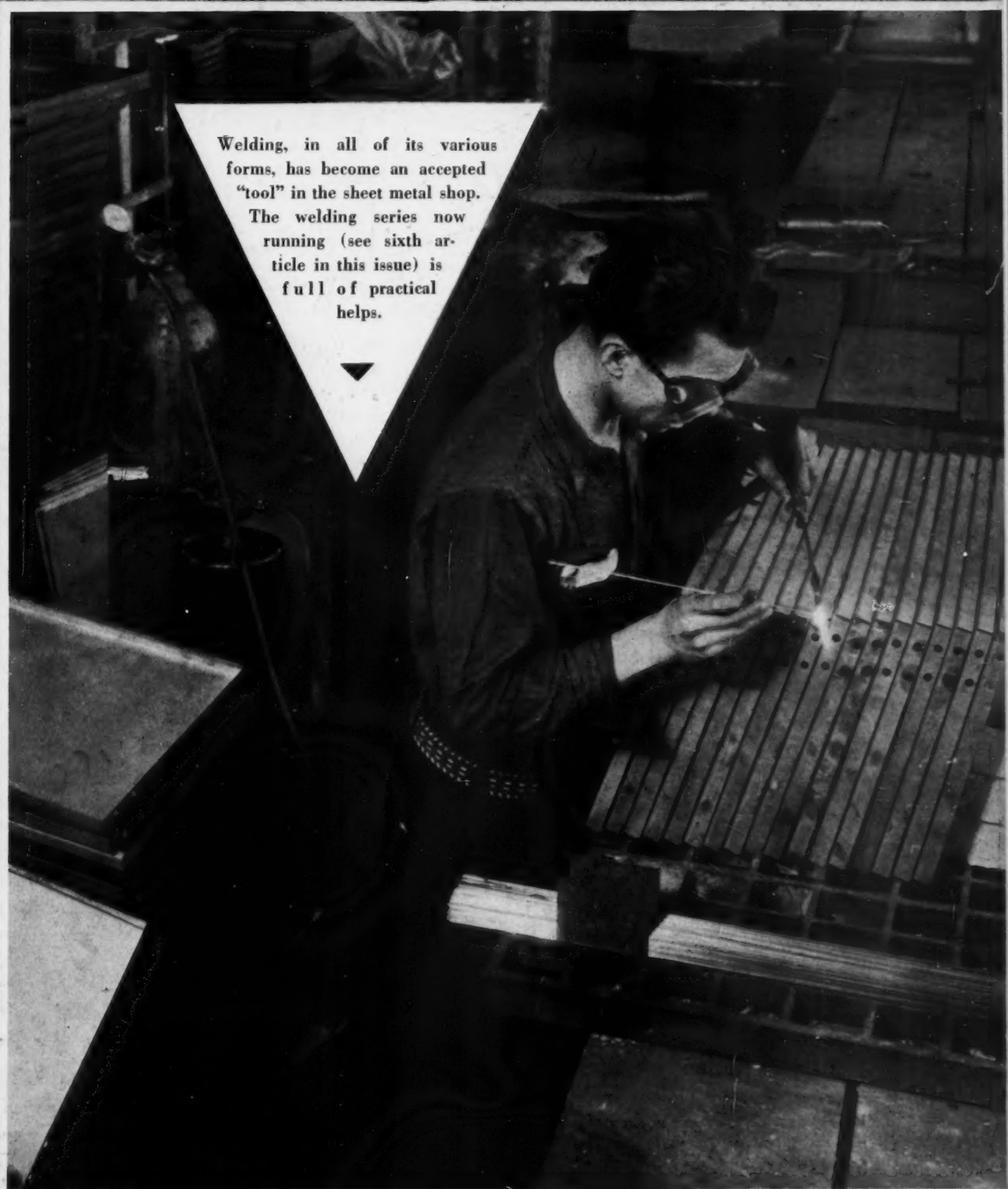
AMERICAN ARTISAN

WARM AIR HEATING • AIR CONDITIONING
SHEET METAL CONTRACTING



Welding, in all of its various forms, has become an accepted "tool" in the sheet metal shop. The welding series now running (see sixth article in this issue) is full of practical helps.

ESTABLISHED
1880

December
1936

THE AIR CONDITIONING SECTION
Page 31

MAKE THE COMING NEW YEAR AND NEW INSTALLATIONS MORE PROFITABLE WITH

REPUBLIC STEEL
REG. U.S. PAT. OFF.
TONCAN
COPPER MO-LYB-DEN-UM
IRON

• Before long you'll be celebrating a new year—a year that, according to all indications, should be a prosperous one for sheet metal contractors. Air conditioning is no longer an experiment or a luxury that only a few home owners can afford. It is a rapidly growing business that offers untold opportunities. • There will be a healthy volume of all types of sheet metal work—repairs neglected during the past four or five years—new work made possible by a general improvement in business. • You have bright prospects ahead for next year, and they can be made even brighter by using the sheet metal that will help you obtain profitable contracts—Toncan Iron. • This rust-resisting alloy of refined open-hearth iron, copper and molybdenum is a quality material that appeals to home owners and other sheet metal prospects. It lasts longer—it saves money—much more over a period of years than its slight additional cost. It will provide you with a real sales argument to obtain those jobs that are ready to fall one way or the other. • You'll find Toncan Iron easy to work. It is exceedingly ductile. It makes possible economies in the shop. And cold-working has no material effect on its high resistance to rust. • Have you a copy of "The Path to Permanence"? If not, write for a copy—it tells the full story.

Look to Republic as a major source of supply for flat and corrugated sheets—Plain Carbon Steel, Copper-Bearing Steel, Copper-Bearing Iron, Toncan Copper Molybdenum Iron and the famous ENDURO Stainless Steels. A quality of sheet for every degree of corrosion-resistance.

Republic Steel
CORPORATION

GENERAL OFFICES · · · CLEVELAND, OHIO

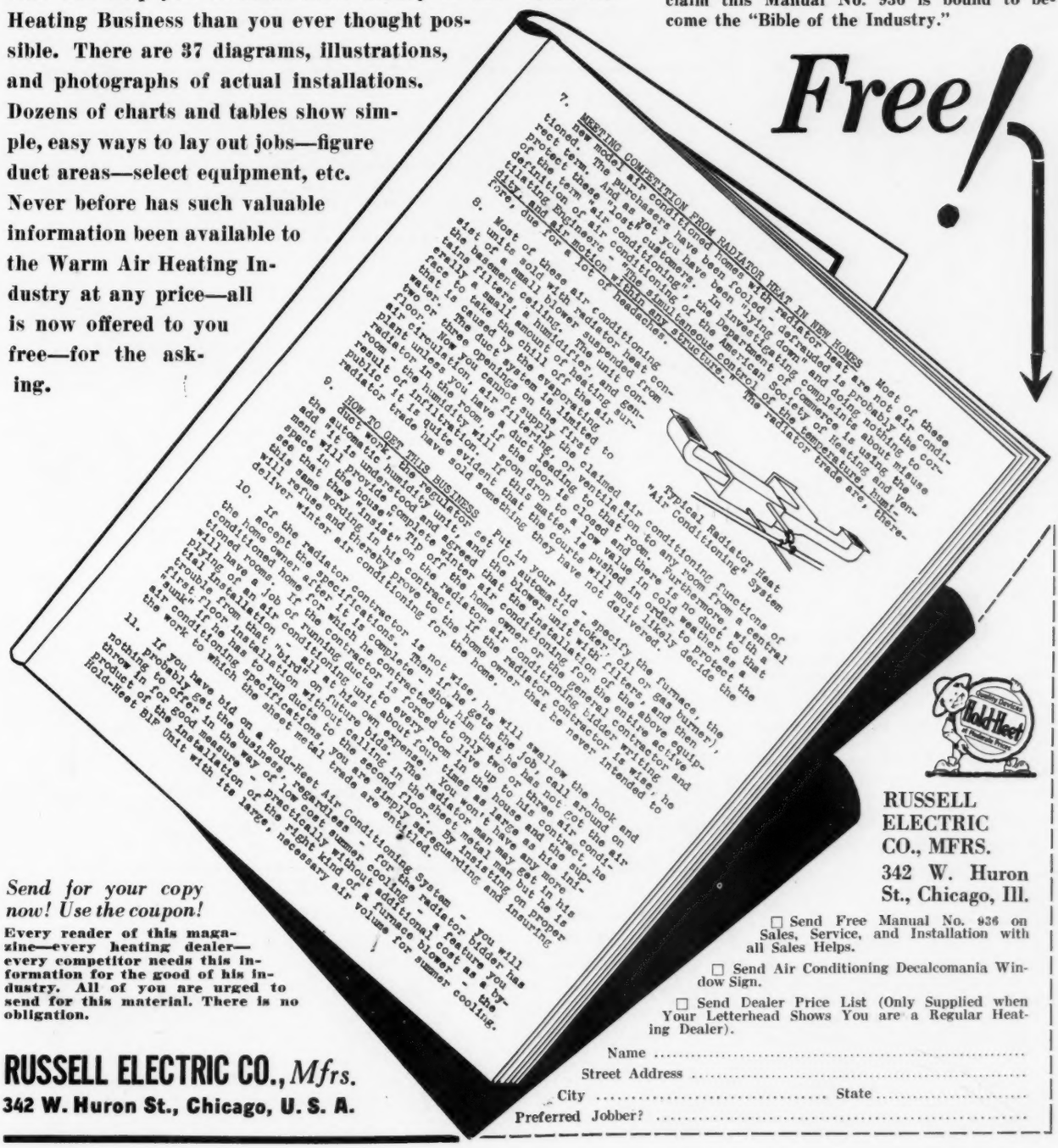
When writing Republic Steel Corporation for further information, please address Department AA.

This Dynamite Blows Up Radiator Heat Competition *In Air Conditioning Homes*

NO RADIATOR HEAT COMPETITION can stand up against the FACTS given in the New Hold-Heet Air Conditioning Sales, Service and Installation Manual No. 936. Read every word of Page 3 which is here reproduced—there are 19 more pages just like it—all packed full of facts that will help you to make more money in the Warm Air Heating Business than you ever thought possible. There are 37 diagrams, illustrations, and photographs of actual installations. Dozens of charts and tables show simple, easy ways to lay out jobs—figure duct areas—select equipment, etc. Never before has such valuable information been available to the Warm Air Heating Industry at any price—all is now offered to you free—for the asking.

YOU, as a Warm Air Heating Man, will throw out your chest when you get these facts. You will be proud of the industry you serve. You have always felt that Warm Air Heating was the best—Here are the facts explained in a simple, understandable manner so that you can PROVE it to your prospects and GET THE BUSINESS. No wonder experts claim this Manual No. 936 is bound to become the "Bible of the Industry."

Free!


7. MEETING COMPETITION FROM RADIATOR HEAT IN NEW HOMES. Most of these new model air conditioned homes with radiator heat are not air conditioned. The purchasers have been fooled - probably is fooling to correct term. And as yet you have been living, or doing nothing to correct these "lost" customers. In investigating the Department of Commerce is using the definition of air conditioning", or the Department of Commerce is about misuse of the term "air conditioning" and doing nothing to correct these "lost" customers. In investigating the Department of Commerce is using the definition of air conditioning - the simultaneous control of the temperature, humidity, Engineers - the simultaneous control of the temperature, humidity, cleaning, and air motion - within any structure - the radiator trade are, therefore, due for a lot of headaches.

8. Most of these air conditioning units are sold with radiator heat - the first to claimed air conditioning functions of a small blower suspended from the basement ceiling. The unit consists of a humidifier, and generally a small amount of heating surface to take the chill off the evaporating air that is caused by the cooling. Furthermore, a central system is limited to two or three openings on the first floor. If duct leading to that room. Furthermore, as a result of inadequate air circulation, air cannot be supplied to any room from a central plant unless you have filtering, or ventilation to that room - the humidity will soon drop to a low value in order to protect the radiator in the room. If duct is closed and there is no duct with a public, if inadequate evident this matter is pushed in cold weather as a result of inadequate air circulation, air filtering, or ventilation to any room from a central radiator trade have sold something they have not delivered. most likely decide the "Air Conditioning" System

9. HOW TO GET THIS BUSINESS. Put in your bid - specify the furnace, the automatic humidity regulator set for automatic stoker, oil or gas burner), add "it is understood and agreed that the blower unit with filters, and then ment will provide complete installation of the above equipspace in the house" on the radiator contract. If the home owner or the general contractor and see that they "insist" on the radiator air conditioning for the home. If the home owner that he never intended to this same wording in his own contract. Then if he gets the job, call around on deliver winter air conditioning for the home.

10. If the radiator contractor is not wise, he will swallow the hook and will refuse to accept the specifications. Then if he gets the job, he has not got the air conditioned home. If the contractor is forced to live up to his contract, he will have a job of running ducts to every room in the house and the supplying of an air conditioning unit at his own expense. You won't have as his investrial installation without calling in the sheet metal man but he is trouble from that third all at future bids. The radiator man may get in his first floor installation without calling in the sheet metal man but he is sunk" if he has to run ducts to the second floor. By insisting on proper air conditioning specifications, you are simply safeguarding and insuring the work to which the sheet metal trade are entitled.

11. If you have bid on a Hold-Heet Air Conditioning System - you will probably get the business, regardless - for the radiator bidder has nothing to offer in the way of low cost summer cooling - a feature you throw in for good measure - practically without additional cost as a by-product of the installation of the right kind of a furnace blower for summer cooling. Hold-Heet Blf Unit with its large, necessary air volume for summer cooling.

Typical Radiator Heat "Air Conditioning" System

Send for your copy now! Use the coupon!

Every reader of this magazine—every heating dealer—every competitor needs this information for the good of his industry. All of you are urged to send for this material. There is no obligation.

RUSSELL ELECTRIC CO., *Mfrs.*
342 W. Huron St., Chicago, U. S. A.

RUSSELL ELECTRIC CO., MFRS.
342 W. Huron St., Chicago, Ill.

☐ Send Free Manual No. 936 on Sales, Service, and Installation with all Sales Helps.

☐ Send Air Conditioning Decalcomania Window Sign.

☐ Send Dealer Price List (Only Supplied when Your Letterhead Shows You are a Regular Heating Dealer).

Name .....
Street Address .....
City ..... State .....
Preferred Jobber? .....

In This Issue

December, 1936, marks the 25th anniversary of air conditioning as a recognized science. We pay some small tribute to the father of the art on page 15.

*

In Chicago, the Hotel LaSalle had a terra cotta roof which leaked and began to fall apart. A solution was found in applying metal sheets over the terra cotta with the metal, in turn, also protected. We show some interesting details on page 16.

*

William Neubecker, one of the true scientists of pattern drafting, continues his articles on skylights on page 22. He gives some short cut methods for finding true lengths of jack, hip and common bars with an ordinary steel square.

*

The articles by Platte Overton on heating of churches really get down to bed rock in this issue when air changes, room temperatures under high ceilings, temperature drop in long ducts are brought out for your consideration. See page 26.

*

In these times of increasingly better house construction most owners (whether contemplating building or remodeling) are interested in ways and means of reducing the heating cost. S. Konzo, on page 42, produces figures which give savings in terms of percentages or in actual Btu for all the different methods of reducing cost.

*

With more and more furnace dealers selling stokers, the problems of stoker operation are coming to the front. The manufacturers generally tell us what makes the wheels go round, but the owner can ask questions not found in the sales manuals. For instance, what causes "coke trees" and are they advantageous or objectionable? For the answer to this and other questions see page 46.

*

One of the simplest methods of sizing ducts is to divide the cfm by the velocity and get the required area in square feet. We can select any velocity which strikes our fancy. S. Konzo in "Facts From the Research Residence" explains the good and bad points of this method, beginning on page 52.

*

On page 56 we show some cross sections and furnish some data for a California house in which warm air is passed through a plenum formed by the floor; also through hollow exterior walls; and with registers for quick heating. In view of the fact that this type of installation seems to be gaining favor we recommend the article for your study.

*

And so into another year. Merry Christmas and an even more prosperous New Year.

AMERICAN ARTISAN

With which is merged

FURNACES and SHEET METALS AND Warm-Air Heating

Covering All Activities in

Gravity Warm Air Heating — Forced Warm Air Heating
Sheet Metal Contracting — Ventilating
Air Conditioning

J. D. Wilder, Editor

Anne A. Kennedy, Assistant Editor — Brewster S. Beach, Consulting Editor

Vol 105, No. 12 — December, 1936 — Founded 1880

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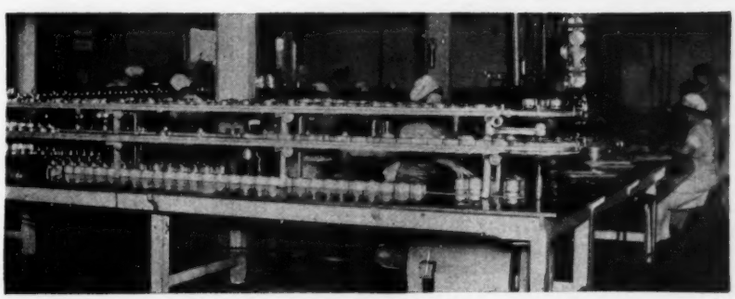
AS LONG AS PEOPLE EAT THREE TIMES A DAY...

You have a chance to sell equipment of Monel Metal to canners, preservers, and packers . . . go after their jobs!

(Above) A live California contractor landed the order for these fruit juice extractor tables. He recommended Monel Metal because it resists the action of fruit acids. That's a point to remember when you talk to makers of preserves, jellies, or other foodstuffs.

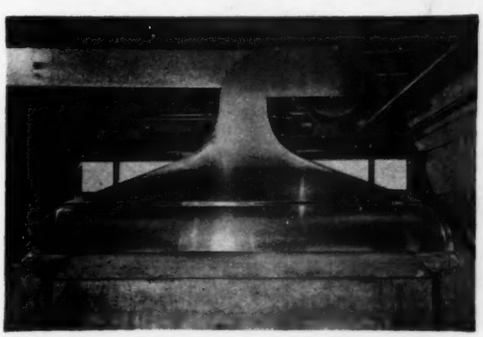
(Right) An Ohio contractor got the order for this batch of scale pans. He proved that Monel Metal resists corrosion and contamination in food handling.



(Above) Evidence that Monel Metal withstands meat packing conditions helped a Seattle (Wash.) sheet metal shop to land this job—Monel Metal-covered tables and shelves in a chicken cannery. We supply you with printed matter you can show your prospects.

(Above) The oyster and fish packing industry offers chances to land many profitable jobs like these oyster washers. Ask for literature you can use with owners of similar plants.

(Right) A Baltimore contractor explained to an oyster packer that Monel Metal can't rust even in salt water, and so he landed an order for this oyster skimmer and pusher. A good job.



(Left) Don't forget the bakeries, cracker, cookie and candy manufacturers: they need equipment that is easy to clean, and buy a lot of Monel Metal. This oven-hood job was landed by a contractor in Schenectady, New York.

THESE photos show the kind of jobs you can get if you go after orders from food packers. First, read up a little on the kind of Monel Metal equipment they use. Then drop around at their factories and tell them that you turn out that kind of work. Do you want to land their jobs? We will send you, *free*, working instructions and detailed lists of the equipment they buy. *That* makes your part even easier. Write.

THE INTERNATIONAL NICKEL COMPANY, INC., 67 Wall Street, New York, N. Y.

MONEL METAL

Monel Metal is a registered trade-mark applied to an alloy containing approximately two-thirds Nickel and one-third copper. Monel Metal is mined, smelted, refined, rolled and marketed solely by International Nickel.

Monel Metal

"THE JAM IS

BROKEN...”

EARLY in 1936 we asked for your business with a smile on our faces and a confident ring in our voices. We had just completed an addition to our factory increasing production capacity over 40%. We believed we merited your business because we could deliver a product of unequaled quality and appearance.

. . . but you know what happened

We underestimated the tremendous and ever growing popularity of our products. Even though we pushed production to far above estimated capacity . . . even though the entire plant went on a 24-hour a day schedule, we could not keep up with the avalanche of orders you sent us. We could not meet your delivery dates.

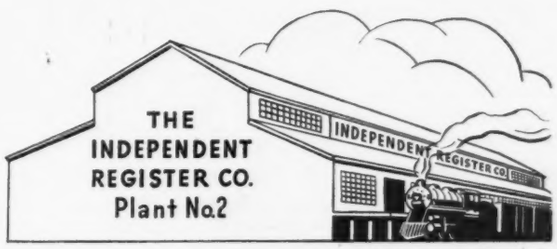
. . . but we still want your business

We want it just bad enough to have invested thousands and thousands of dollars in a new plant and equipment which more than doubles our capacity . . . a plant which should more than care for the increased demand for Independent Registers in 1937.

. . . the jam is broken

Our new plant is now equipped and manned to take care of a great increase in business. Orders are flowing smoothly through production and we are confident that in 1937 Independent service will fully equal the quality of Independent Registers and Grilles.

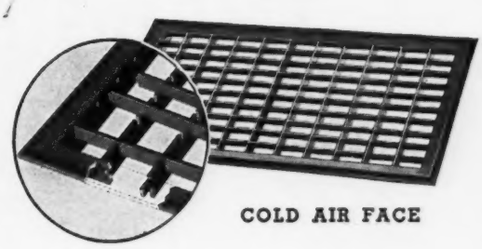
THE INDEPENDENT REGISTER CO.
3747 EAST 93rd STREET • CLEVELAND, OHIO



INDEPENDENT "Fabrikated" (REG. U.S. PATENT OFFICE)

REGISTERS • COLD AIR FACES • GRILLES

FLOOR REGISTER



COLD AIR FACE

ADJUSTABLE DIRECTED AIR FLOW
AIR CONDITIONING REGISTER

NOW YOU CAN PAINT GALVANIZED SHEETS

EASIER, BETTER, MORE DURABLY!

Many attempts have been made to provide a galvanized sheet surface that would take and hold paint — hold it well and long. Some have been partly successful . . . others have failed. Now see how much farther Armco Paintgrip goes toward solving these problems. This greatly-improved paint-holding sheet was developed in collaboration with the Parker-Rustproof Laboratories and represents a distinct advancement beyond anything else heretofore developed for this purpose.

Perhaps its greatest advantage is a *full-weight pure zinc coating.* The fine-textured surface of Armco Galvanized Paintgrip sheets can be painted *immediately* with every assurance of a tenacious paint-bond. No more long-time chemical etching, with its accelerated corrosion; no more weathering.

You know how vital it is to preserve the natural elasticity of the paint on a metal surface. Here Armco Paintgrip sheets have made a real conquest. Besides a good physical surface for mechanical adhesion, Armco Paintgrip insures a chemical neutrality *that definitely retards the drying out of paint's essential elasticity.* This means a much longer life than for paint applied to an etched or weathered surface.

These are the quick facts. Read more about the properties of Paintgrip in our new illustrated folder. Your copy awaits you. Just use the convenient coupon below or write us on your firm letterhead. The American Rolling Mill Company, Executive Offices, 703 Curtis Street, Middletown, Ohio.

OTHER ARMCO GRADES. There is a type and grade of Armco sheet metal to meet almost every conceivable requirement. No matter whether your demands are standard or for sheets of special analysis, you can choose the right grade of Armco Ingot Iron, steel or stainless steel to do the job. All are available in a full range of sizes, gages and finishes.

ARMCO, Middletown, Ohio
Send me copy of "Do It With Armco Galvanized Paintgrip Sheets."
We need paintable galvanized sheets for this purpose_____

NAME_____
COMPANY_____
ADDRESS_____

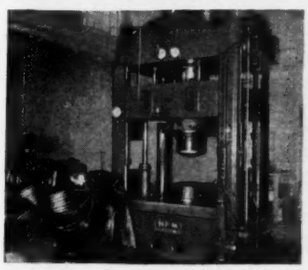
AA-12-36

ARMCO PAINTGRIP SHEETS

ARMCO

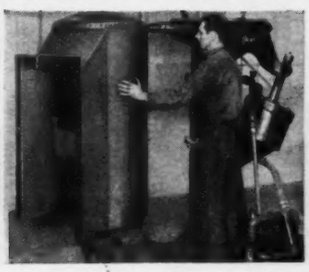
SUNBEAM STEEL FURNACES

NEW MODERN TOOLS AND MACHINERY FABRICATE EVERY PART OF COMPLETE UNIT



500 Ton Press forms boiler plate into shell and radiator heads — also forms the radiator body.

The shell is curved into shape by this Power Roll Press after the Leaf Brake (left) establishes the angle.



Assembled heads and bodies of shell and radiator are cold riveted — quickly, securely.

After riveting, all joints are welded for gas tight operation—to make Sunbeam Furnaces doubly leak-proof.

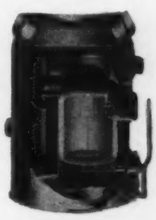
HERE'S a new factory answering the demand for more Sunbeam Steel Furnaces. It's completely and newly equipped with every modern tool and machine to make the best steel furnace that modern inventive and manufacturing genius can produce. Every part of the furnace is fabricated under one roof: the shells are made of 7 gauge boiler plate, the heads are 6 gauge, the radiators of 12 gauge plate. Cast iron parts too—grates and fronts—are made right here.

All Sunbeam Steel Furnaces are doubly sealed and reinforced. They are welded **and** riveted. Their quality, material and workmanship mean profit to dealers who handle them. Sunbeam Furnaces are stocked for immediate delivery by wholesalers and warehouses all over the country. Mail the coupon today for the name of the jobber nearest you.

THE FOX FURNACE CO., ELYRIA, OHIO

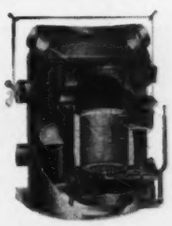
Division of American Radiator & Standard Sanitary Corp.

SUNBEAM
WARM AIR FURNACES AND AIR CONDITIONING UNITS



500 SERIES SUNBEAM STEEL FURNACE

High quality at low price. Helps you meet competition with a better furnace.



8000 SERIES SUNBEAM STEEL FURNACE

The finest steel furnace made, with every quality feature. For coal, oil or stoker.

THE FOX FURNACE COMPANY, ELYRIA, OHIO

Please send details on Sunbeam Steel Furnaces and tell me the Jobber nearest me who stocks them.

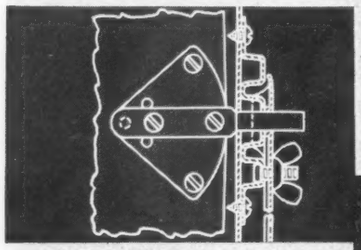
Name.....

Address.....

City..... State.....A-12

AGAIN Parker-Kalon leads

NOTABLE IMPROVEMENTS in Parker-Kalon Dial Damper Regulator



PREVENTS AIR LEAKAGE

This cross section shows how the unique, one piece frame construction seals the opening in the duct to prevent leakage of air . . . promoting efficient operation of the system.

NEATER — STRONGER SUITED TO ALL DUCT SHAPES

The one piece heavy gauge steel frame is extra strong. The shape permits installation in any required position on either rectangular or round ducts. Markings on face of frame are large and clearly defined to show position of damper at a glance.

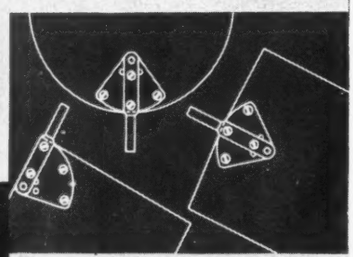
EASILY OPERATED

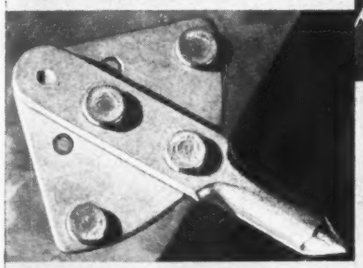
Free and easy operation of the Regulator is assured by the flanged construction of the lever which rotates upon the hub of the frame. Another feature is the extruded lever opening which provides ample contact for Bearing or rod, eliminating damper rattle.

EXCLUSIVE ADVANTAGES of Universal Damper Bearings

ADAPTABLE TO ANY DAMPER

The Bearing is adjustable on its mounting plate, making Universal Damper Bearings equally satisfactory for regular or splitter dampers.





REENFORCES DAMPER . . . EASY TO INSTALL IN DUCT

Cold-forged from steel, these Bearings will not bend and cannot break. The steel mounting plate reenforces the damper and prevents buckling. Another feature is the point on the round-end Bearing which makes it easy to insert in duct.

CADMIUM PLATING PROTECTS BOTH REGULATOR AND BEARINGS FROM RUST

. . . . . with this Improved Dial Damper Regulator! .. and the New Universal Damper Bearings!

Originators of the first Dial Damper Regulator . . . the most popular damper control . . . Parker-Kalon again scores with the *Improved* Dial Damper Regulator and the *New* Universal Damper Bearings. Now, as the result of mechanical improvements and refinements they are more than ever before the most practical and efficient devices obtainable for manually controlling dampers in heating, ventilating and air conditioning systems.

Study the features of design and construction which are illustrated here. Note the improvements made in the Parker-Kalon Dial Damper Regulator. Learn the advantages of the radically different design of the *New* Universal Damper Bearings. Then mail the coupon for a *Free Sample* of the No. 14* set and see for yourself their superior features. What's more—they cost no more than the old style.

COMPLETE SETS

**Set No.* 14 *Contains:* One ¼" Improved Dial Damper Regulator, one set of Universal Bearings and all the necessary fastening accessories. For Dampers up to 10".

Set No. 19 *Contains:* One ⅜" Improved Dial Damper Regulator, one set of Universal Bearings and all the necessary fastening accessories. For Dampers up to 20".

Regulators and Bearings also sold separately.

PARKER-KALON CORPORATION
190 Varick Street New York

Products of PARKER-KALON

the Field!
OPEN
SHUT
PARKER-KALON CORP. N.Y.
PAT. 1324620 OTHERS PEND.
HYRO
DIAL DAMPER
REGULATOR
for controlling dampers in heating and ventilating, air conditioning, blower and exhaust systems
PARKER-KALON CORPORATION
Hyro Dept., 190 Varick St., New York, N. Y.
Send Free Sample of New No. 14 Dial Damper Regulator
Set, descriptive Bulletin and prices. Also names of nearest distributors.
Name and Title
Company
Address

CORPORATION SOLD ONLY THROUGH RECOGNIZED DISTRIBUTORS

LOOKING BACKWARD!

WITH the approach of the holiday season and a new year we reminisce of the one now passing. It has been a fine year for our organization, made so by you . . . the Warm Air Furnace Dealers of America. We hope that you also have profited from the many orders you have sent us. 1936 has proved to be a good heating year, and the high proportion of business that we received convinces us that the buying public, through the efforts of you dealers, have found Peerless Products superior in quality and engineering principles, which have influenced their decision in buying this equipment. We wish to thank you for your many fine orders . . . for your co-operation . . . for your loyalty . . . and it is our sincere desire that you enjoy a prosperous and successful 1937.

PEERLESS FOUNDRY COMPANY 1853 LUDLOW AVE. INDIANAPOLIS, IND.

PEERLESS HOME HEATING EQUIPMENT

A ZINC COATED SHEET WITH

Enduring Heat Resistance

GALVANNEALED TRADE MARK YOUNGSTOWN SHEETS

★A 25-gauge Youngstown Galvannealed Sheet, formed into a 4" cylinder, was placed in an electric furnace, heated to 600° for 8 hours, allowed to cool overnight and then reheated for 8 hours. This alternate heating and cooling was repeated daily for 14 days. Even at the end of this rigorous test, the sheet showed absolutely no deterioration.

★Wherever zinc-coated steel is to be subjected to intense heat, as in the oven shown here, the safest specification is Youngstown Galvannealed Sheets. The Youngstown patented heat-treating process actually fuses the zinc coating to the base metal. Write for details and prices.

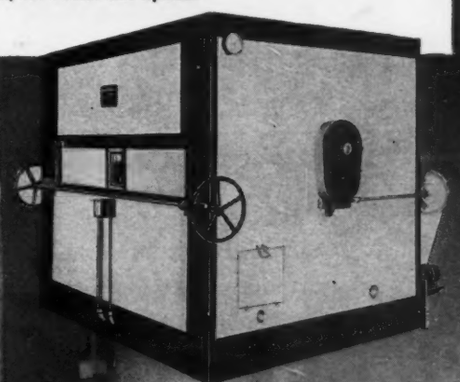
THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon and Alloy Steels

General Offices - - YOUNGSTOWN, OHIO

Sheets; Plates; Tubular Products; Conduit; Tin Plate; Bars; Rods; Wire; Nails; Unions; Tie Plates and Spikes.

638

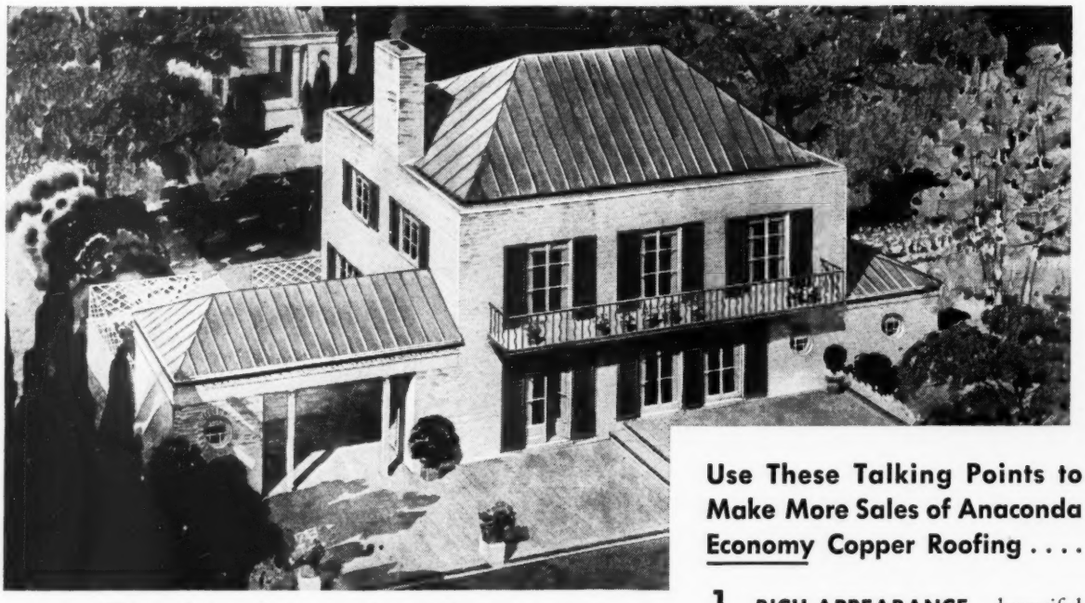


Youngstown

YOUNGSTOWN Galvannealed SHEETS

NEW OPPORTUNITIES TO SELL METAL ROOFS

Let Anaconda Economy Copper Roofing help you get your share of the increased residential roofing business



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from mine to consumer

Anaconda Copper

THE AMERICAN BRASS COMPANY, General Offices: WATERBURY, CONNECTICUT

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AMERICAN ARTISAN

Volume 105 Number 12

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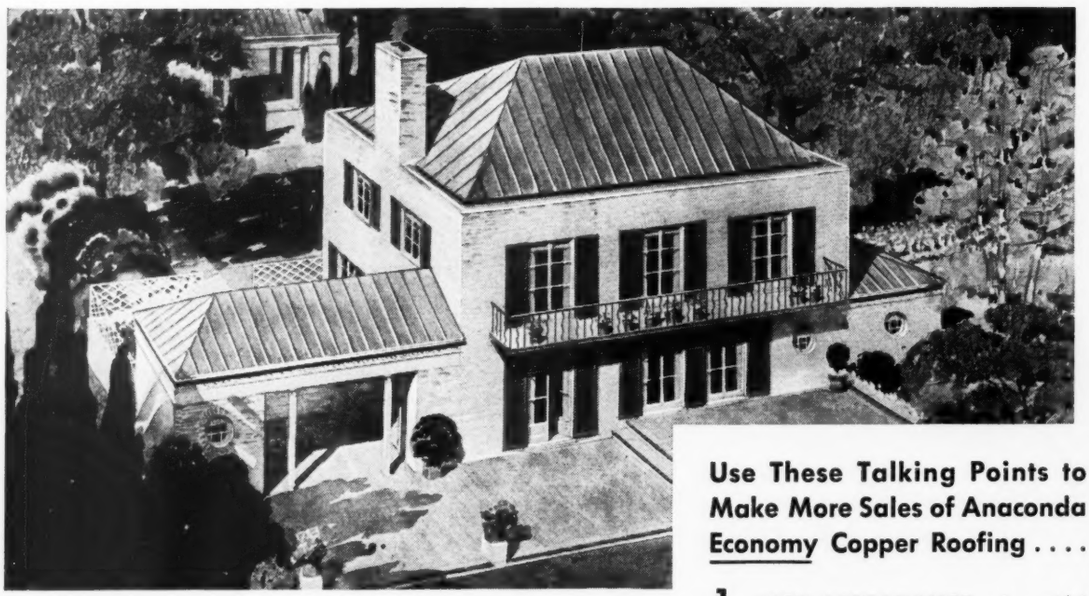

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Left—the mansard roof covered with terra cotta and right—the new metal roof.

Protected Metal Replaces Terra Cotta on a Mansard Roof

AN unusual sheet metal remodeling project has recently been completed in Chicago where the Hotel LaSalle covered an old terra-cotta roof with protected metal. The original roof, laid when the hotel was built many years ago, consisted of a terra-cotta tile covered mansard roof with numerous projecting dormers of concrete and masonry and copper hips and cornice.

In recent years the terra-cotta tile loosened and fell down or cracked and opened to the weather resulting in an unsightly, dangerous and leaky roof. Repairs with duplicate materials would have been costly and would not have prevented future trouble with old tile so the owners decided that a metal roof would be the most attractive, least costly and most substantial alteration. Copper protected metal as manufactured by the H. H. Robertson Company was selected for the work.

In order to save time and money a survey was made to determine whether or not the new metal could be laid without removing all the tile. The contractors decided that this could be done so methods were developed to leave the tile in place, remove the old copper (which incidently, was in first class condition) and fasten the new metal to the roof framing.

Metal Support

As shown in the detail drawings, 4-inch channel girts were bolted through the tile into the steel framing of the roof on 4-foot centers. These new girts run horizontally along the roof, and are carried against the masonry of the dormers, between dormers. The bolts to hold the girts are ⅝ by 10-inch with heads countersunk in the girt to provide a flush surface beneath the sheets and held with a nut on the inside of the roof. This is shown in one of the details.

Beginning at the gutter 33-inch wide sheets were laid in courses across the roof. The first course used a 6-foot sheet; the second and third courses 8 foot 6-inch sheets which brought the metal to the top of the high dormers. One 9-foot sheet course carried the metal to the base of the new cornice. Above the small dormers the sheets were progressively shortened to conform with the 6-foot 10½-inch radius of the dormer top. The sheets above the large dormers were shortened to a 11-foot ½-inch arc.

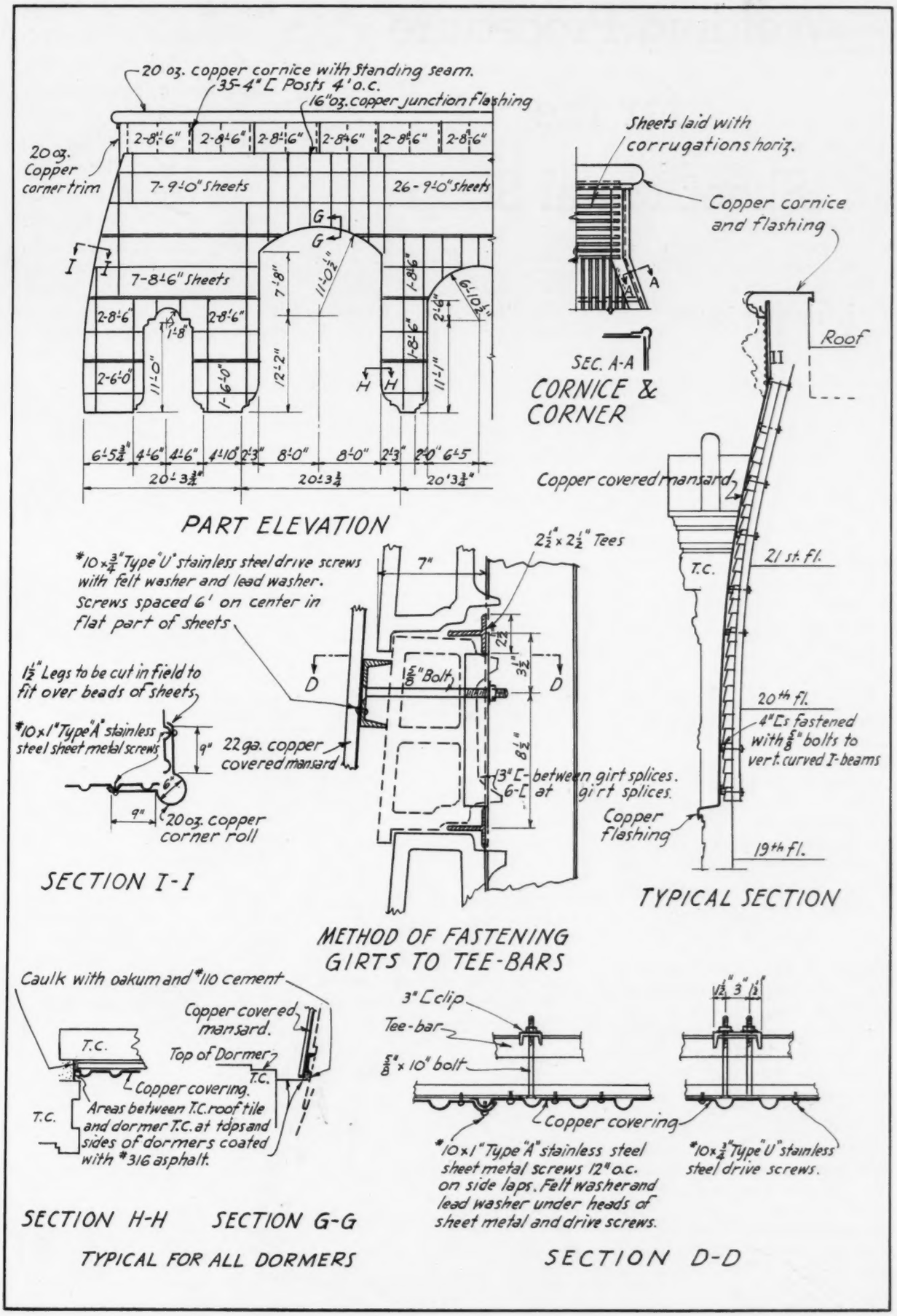
The corrugated sheets of the mansard were cut to fit the curve of the hips and carried to a junction. The space between sheet edges was covered with a 20-ounce copper corner roll, the edges of which were riveted through the corrugations of the roof sheet. This is shown in a detail.

Roof Sheets

The roof sheets are fastened to the channel girts with ¾ and 1-inch stainless steel sheet metal screws in the valleys of the sheets at about 12 inch centers. Each screw has a felt washer and a lead washer under the heads. A suitable diameter hole was drilled through the roof sheet and the girt to start the screw. The roof sheets are lapped 6 inches top and bottom and 3 inches, or one corrugation, up and down.

Above the fourth roof course the new cornice consists of roof sheets laid with the corrugations running horizontally requiring two sheets to give the necessary height. The base of the cornice is flashed with copper over the roof sheets. The top of the cornice consists of a 20-ounce copper rolled edge which is turned inward and down to form a flashing above the horizontally laid face

(*Continued on* page 90)


20 oz. copper cornice with Standing seam.
35-4" L Posts 4' o.c.
16" oz. copper junction flashing
20 oz. Copper corner trim
7-9'-0" Sheets
26-9'-0" Sheets
7-8'-6" Sheets
PART ELEVATION
Sheets laid with corrugations horiz.
Copper cornice and flashing
SEC. A-A
CORNICE & CORNER
Roof
Copper covered mansard
21 st. fl.
20th fl.
19th fl.
4" L's fastened with 5/8" bolts to vert. curved I-beams
Copper flashing
TYPICAL SECTION
*10 x 3/4" Type "U" stainless steel drive screws with felt washer and lead washer. Screws spaced 6' on center in flat part of sheets
1 1/2" Legs to be cut in field to fit over beads of sheets
*10 x 1" Type "A" stainless steel sheet metal screws
22 ga. copper covered mansard
20 oz. copper corner roll
SECTION I-I
2 1/2" x 2 1/2" Tees
5/8" Bolt
3" L between girt splices. 6-L at girt splices.
METHOD OF FASTENING GIRTS TO TEE-BARS
Caulk with oakum and *110 cement
Copper covered mansard.
Top of Dormer
Copper covering.
Areas between T.C. roof tile and dormer T.C. at tops and sides of dormers coated with *316 asphalt.
SECTION H-H SECTION G-G
TYPICAL FOR ALL DORMERS
3" L clip
Tee-bar
5/8" x 10" bolt
Copper covering
*10 x 1" Type "A" stainless steel sheet metal screws 12" o.c. on side laps. Felt washer and lead washer under heads of sheet metal and drive screws.
*10 x 3/4" Type "U" stainless steel drive screws.
SECTION D-D

Welding Procedure for the Sheet Metal Shop

By J. Carl Wilson

The fabrication of kitchen and restaurant equipment is an activity followed by many shops having power equipment. Welding apparatus is practically essential for this class of work. This article answers some questions on stresses in joints with sketches showing practical methods.

Kitchen Equipment

THE fabrication of kitchen equipment is a large field and one of the best in the sheet metal industry in which to apply arc welding for smoothness, economy and salability of articles such as sinks, steam tables, hoods, warming cabinets and serving counters.

It is not necessary to restrict ourselves to any one particular kind of metal. It is quite common to make some parts of these articles of galvanized iron and other parts of stainless steel or bright metals. The two metals are easily joined by welding and make a highly satisfactory job.

The design of articles in most cases may need to be changed somewhat as a joint designed for rivets can not always be welded economically and by the same token a weld joint can not be riveted satisfactorily. Definite information can be had from any of the manufacturers of welding apparatus if the product, problems or materials are described in detail.

Restaurant Sink

In Fig. 1, we choose a restaurant sink, as it offers a good problem of design, and demonstrates the advantages of welding. Letter B in the drawing indicates bends; letter W indicates welds. Section AA shows back or flat type seam before and after welding. When the inside of the seam is filled with solder in the manner shown the seam is completely concealed and is sanitary. Section BB shows a type of corner seam and gusset plate supporting the drain board. Section CC shows a partition. Note this is welded at the toe and soldered at the heel; this eliminates any place for bacteria and makes for more sanitation. Section DD through drain board and gusset showing ½-inch split pipe finish for all raw edges. Legs for this type of sink are made in this manner—take a piece of angle iron notched and formed to fit the bottom of the sink, one flange is turned up and the other under the sink, butt the angle iron legs to this and weld them. Now make eight 6x6-inch triangular gusset plates to stiffen the legs, weld these on as shown. This is all the bracing that is necessary. Jigs are not necessary for this as the welds are short, all you need do is fit and tack weld the pieces then go ahead and finish the welding; after the welding is complete do the soldering on the inside.

Strength and Design

Calculation of the designed strength of all welded joints should include consideration of the following factors—strength of weld, type of weld, location of weld in relation to parts joined. The "Code for Fusion Welding" (Structural), allows an average tensile strength of 45,000 pounds per square inch for welds made with a bare or lightly coated electrode which conforms to the former American Welding Society specifications E-1A, E-1B. Welds made by the shielded arc process have a tensile strength of 60,000 to 80,000 pounds per square inch.

Weld Strengths

In calculating the strength of fillet welds, the usual unit stress employed is 11,300 pounds per square inch for tension, shear and compression. Since in practically every fillet weld shear is present, values 20% to 30% higher than those given above may be used in safety when welding is done with shielded arc and proper electrodes.

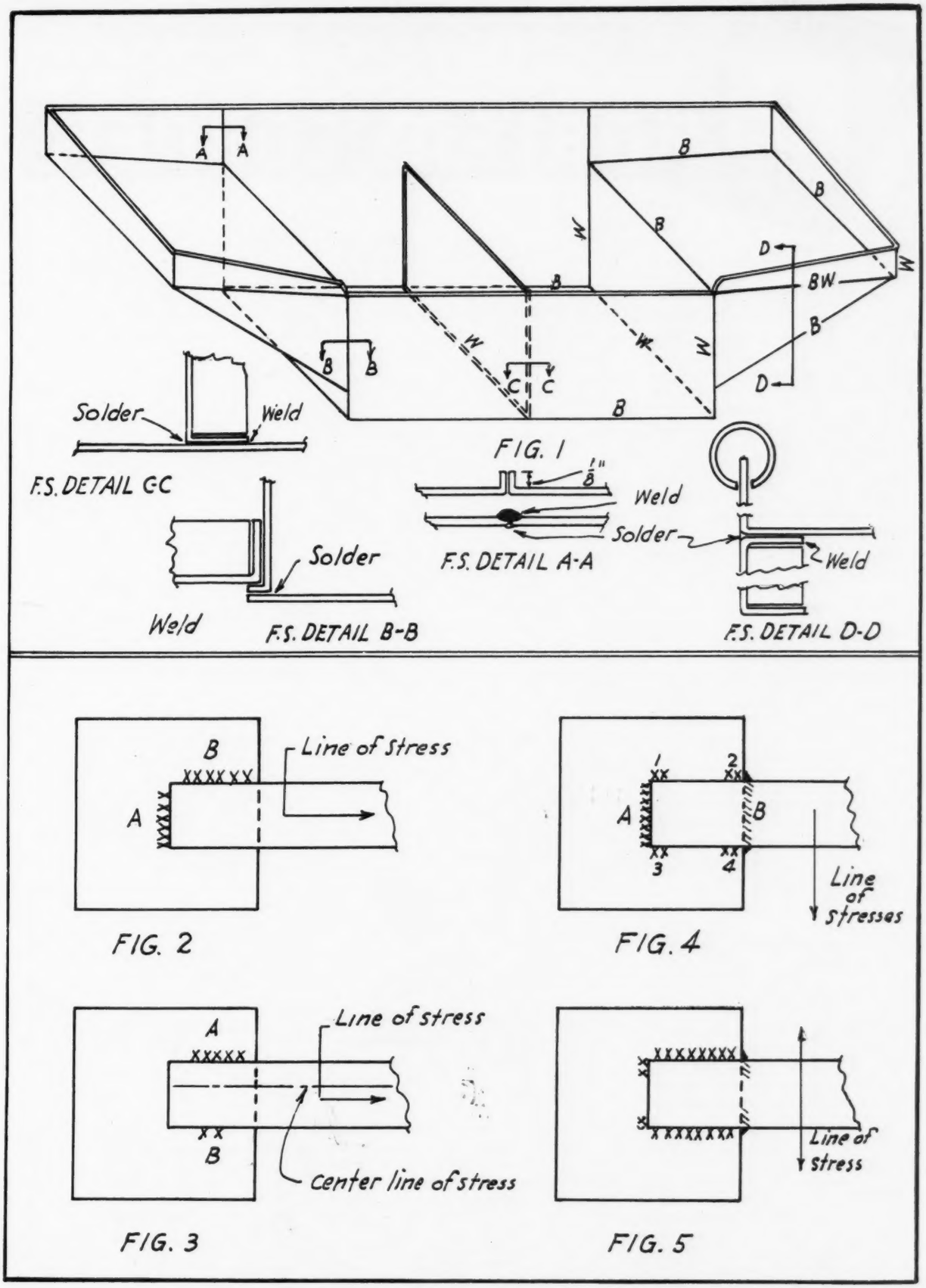
The following table gives the safe working values of fillet welds in shear in accordance with the fusion code and also for welds made by the shielded arc process.

For dynamic, vibrational or lifting loads the unit stress of fillet welds should be reduced depending upon the severity of the load and the character of the weld metals. One-fourth inch should be added to the calculated length of the weld and all craters should be filled. The working strength of butt welds of 100% penetration into the base metal is usually calculated by multiplying the net cross sectional area through the throat of the weld by

(*Continued on page* 100)

SAFE ALLOWABLE DEAD WEIGHT LOADS FOR FILLET WELDS IN SHEAR

Size of fillet weld	Pounds per lineal inch: Fusion Code (structural)	Shielded arc process
3/32	250	315
1/16	500	625
3/32	750	940
1/8	1000	1250
3/16	1500	1875
1/4	2000	2500



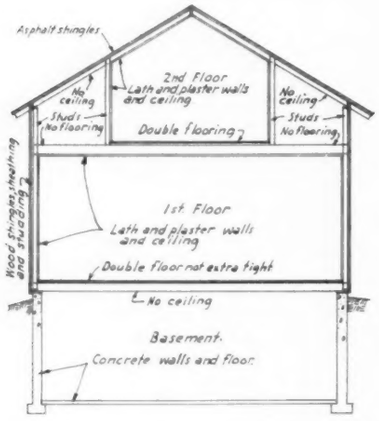
[Details of construction for a restaurant sink and graphic illustrations of welds in stress]

THE PROBLEM CORNER

Heat Loss Factors

American Artisan:

I would appreciate it very much if you would send me the coefficients and factors for the walls, floors and ceilings on the enclosed sketch for both heating the first and second floors and for heating the first floor only. If the second floor is heated it will be just the center room which is marked 2nd Floor on the sketch. The ceiling on the first floor will have two different coefficients and factors. The bedrooms are on the first floor, so what coefficient and factor would you use for the partitions,



as the bedrooms will not be heated all the time or possibly very seldom? The partitions are lath and plaster, both sides. The books I have differ on their coefficients and it is hard to tell just which coefficient I should use, and if I use the right coefficient would I figure thiry-five degrees or seventy degrees for zero outside and seventy degrees inside for the rooms next to the unheated spaces?

C. A. W., R. I.

Reply by
The Editors

All coefficients of heat transmission are based upon the coefficients as published in the ASH&VE GUIDE of 1936. We suggest that you use 70 deg. temperature differential for exterior walls and 35 deg. temperature differential for cold inside walls. For instance, the room on the second floor will figure as having two outside cold walls at a 35 deg. temperature differential and a cold ceiling at 70 deg. temperature differential. We can not tell from your sketch whether the two end walls are exterior or inside.

The coefficient of heat transmission for the outside walls shown in your sketch consisting of wood shingles, sheathing, studding, lath and plaster, no insulation, will be 0.25. The coefficient of transmission for the ceiling on the second floor room will be 0.32.

The coefficient of transmission for the first floor ceiling beneath the heated room will be 0.24. We would not figure any heat loss for the first floor unless there is no heat in the basement.

The coefficient of transmission for your first floor ceiling beneath the unheated attic area would be based upon a coefficient of 0.62 times a temperature differential of 40 deg.

If the basement exterior walls are poured concrete without any interior finish, the coefficient is 0.79 for 6 inch, 0.62 for 10 inch, 0.48 for 16 inch, 0.41 for 20 inch, and the temperature differential ordinarily is figured at a ground temperature of 55 deg. to the inside temperature of 70 deg., making a temperature differential of 15 deg. However, a number of engineers have told us recently that this results in a chilly feeling due to the fact that the walls are always cold and to offset this, they figure the temperature differential of walls below ground just the same as if the walls were exposed; in other words, a 70 deg. temperature differential.

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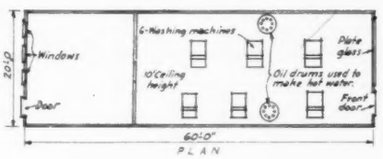
Condensation

American Artisan:

Can you give me any suggestions on the following problem?

The sketch shows a laundry and location of some of the machines generating steam. Moisture gathers on the ceiling and then drops down on the workers below. We would like to eliminate the gathering of moisture or install some means for preventing dropping of water.

C. P. F., Texas.



Reply by
The Editors

The fact that moisture drops from the ceiling in the laundry shown on the sketch you mailed in, indicates that the air inside the building is always 100 per cent saturated and that the air has no further capacity for holding moisture.

In cases of this kind, there are three possible solutions:

1. Sealing the building and rapidly circulating the air through cold sprays or coils so that the moisture is taken out of the air by the spray or coil.
2. Increase the temperature within the building, so that the air has still greater moisture-holding capacity.
3. Create a large exchange of air by bringing in large volumes of outside air and removing equal volumes of inside air.

Suggestion one is probably not practicable and therefore we will not discuss it.

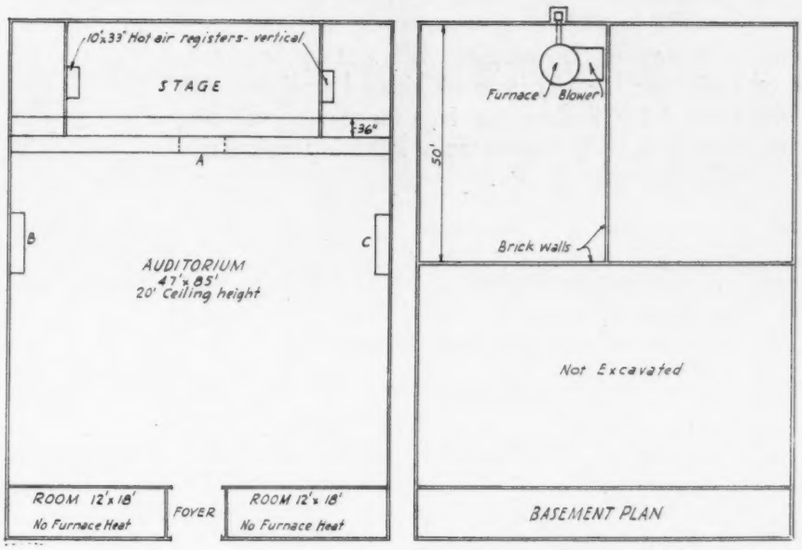
Suggestion two is probably not in order as we judge the temperature in the laundry is already rather high, and to increase the temperature will be objectionable.

Suggestion three seems to us to be most practical, and to describe a satisfactory system briefly, we suggest that provision be made either through windows or special openings so that air from the outside can be drawn into the building. Such openings should be on all sides and not more than window height above the floor. The warm air, saturated with moisture, rises to the ceiling as described in your letter, and should be removed from as near the top of the roof or ceiling as possible. If the roof is flat, air should be withdrawn from perhaps four locations. If the roof is pitched with the ridge at the center, air should be withdrawn at the ridge from possibly two locations. It might be possible to withdraw sufficient volume of air by means of gravity ventilators, but a more satisfactory method would be to use exhaust fans which will operate regardless of wind direction or outside conditions.

For conditions of this type, we believe that a four or five-minute air change will be satisfactory.

The best possible system would be to drop hoods as closely above the washers as possible and connect these hoods by ducts to one or two center blowers, so that the air will be gathered at the machine rather than in the top of the room.

The Problem Corner . . . . .



Church Problem

American Artisan:

We would like to have your heating expert's opinion on a local problem in heating covering the best way to remove the cold air.

The furnace will be placed in the rear under the stage in the basement and we can arrange to take the cold air from under the stage platform at "A," or we can take it from both sides of the building, run it between the joists to the center of the basement room and carry it down to a concrete duct in the floor and to the blower.

The installation will be forced air with a double blower and ¾ h.p. motor. We enclose a sketch of the basement.

A. H., Nebraska.

Reply by
The Editors

Rather than furnish suggestions for the heating problem contained in your letter, we prefer to send copies of the plan to three engineers who have been doing church heating work for from fifteen to twenty-five years. Their opinions and suggestions are unquestionably better than ours.

Reply by
G. A. Voorhees, Indianapolis

The church problem submitted with your May 14th letter is one of these jobs on which I hesitate to express opinion wthout more information.

For instance, if the warm air supply registers which are designated as vertical registers, are baseboard or wall registers of conventional type, I imagine that with both of them discharging air towards the center of the platform, there will be a continuous swirl of warm air in that end of the building.

Then if the return air face is placed at the point "A," there may be a pronounced tendency for it to withdraw some of the eddying current of heated air which had swirled to the floor.

Therefore, without knowing more details regarding the building and the heating plant, my "snap" judgment would be to locate the return air faces in the auditorium at points "B" and "C."

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Duct Velocities

American Artisan:

I would like the following information if you have it available: In a mechanical warm air heating system what is the average velocity of the air for a home of 8 to 10 rooms in the main duct, risers, new type of warm air registers at base board and return air grills in the base board?

Would like to get the names and addresses of cities that have a Heating, Ventilating and Air Conditioning code, also the price for same.

Please mail me copies of some of the Charts and Graphs that you have printed in the last two years on figuring B. T. U. loss and duct sizes, etc.

G. C. S., Penna.

Reply by
The Editors

In answer to your question, we would say that there is no average velocity now in use for mains, risers and registers. Three years ago, the industry generally used main velocity of 500 to 600 F. P. M., but in the last two years, the velocity has increased and I would say that the average is now nearly 800 to 900 F. P. M. It is not at all unusual to find 1,000 to 1,200 F. P. M. near the bonnet today. This would apply to all sizes of houses, but particularly to the house larger than six rooms.

Riser velocity will probably average 200 F. P. M. lower than the velocity suggested above.

The University of Illinois suggests that diffuser type registers at the base board can carry 400 to 500 F. P. M. without objectionable draft. Diffuser type registers in the high side wall can carry up to 800 F. P. M. Plain faced base board registers should have a velocity of 250 to 300 F. P. M., while plain high side wall, above the six foot level, can carry 400 to 500. You understand, of course, that the velocity of high side wall registers is usually determined on the basis of carrying the air stream to outside walls and whatever velocity is required is used.

We attach a compilation of cities which to our knowledge now have some form of a heating code.

It is physically impossible to send you copies of all of the charts and graphs covering Btu loss and duct sizes as published in the last two years, as practically every issue has carried something of this nature. If you will tell us just what problem you are interested in, we probably can select one or two articles bearing on the subject.

◆

Factor 1.07

American Artisan:

In Platte Overton's book, "Forced Air Heating," page 24, where does he get 1.07 in the expression

$$\frac{26{,}200}{355 \times 1.07} + 70 = 139°?$$

Where can I get further information on selection of register temperature?

Where can I get information regarding selection of, or how to determine size of return registers?

H. G. O., Michigan.

Reply by
The Editors

The 1.07 you ask about is derived from the following equation: $60 \times 0.075 \times 0.24$ equals 1.08 in which 60 equals the number of minutes in one hour, 0.075 equals the weight of one cubic foot of air at 70 deg., 0.24 equals the specific heat of air.

Mr. Overton has used 1.07 rather than 1.08 as he used a weight for air of a few hundredths of a pound less than the 0.075 quoted.

A considerable amount of information on register temperatures, register location and sizes appears in the first part of the series by S. Konzo. These articles of Mr. Konzo's have been reprinted by a special method with 21 articles included under one binding.

We shall be very glad to answer your specific questions referring to registers if you will tell us just what information you desire.

Skylight Construction

Showing the procedure in designing, developing, fabricating and estimating the quantities of materials for any type of hipped skylights with rules for computing the factors for finding the true lengths of the hip, jack and common bars, using the steel square as a lightning calculator for any size skylight

By William Neubecker
Head Instructor,
Sheet Metal Department, New York Trade School

THERE are various methods of finding the true lengths of skylight bars, regardless of what the size of the skylight may be. Some mechanics make a scale drawing which is very inaccurate if the drawing is not accurately scaled. Others use a triangle—one for the common and jack bars and the other for the hip bar.

The third and best method is to find the factors for computing the lengths of the hip, jack and common bars. This is a simple method and, if one is not so proficient, the steel square will do away with a lot of mathematical calculation. The first requirement is to know the pitch of the skylight and the rules which follow are applicable, regardless of what the pitch may be.

In this case we will take the standard pitch of one-third and Fig. 16 will give an example, namely, a hipped skylight 3 ft. 6 in. by 8 ft. 2 in. with a 6 in. *wide* ventilator. To find a one-third pitch, take any number which, when divided by 3, will give a whole number. Take $\frac{24}{3} = 8$, the altitude of a right angle triangle whose base is 12, as shown in Fig. 17. To obtain the length of the hypotenuse, extract the square root of the sums of the squares of the altitude and base thus: $\sqrt{8^2 + 12^2} = 14.42$. $14.42 \div 12 = 1.2$, the factor for finding the true lengths of the common and jack bars for any size skylight having one-third pitch.

This same hypotenuse length can be obtained by using the steel square as shown in Fig. 18. Lay the rule from 8 on one leg of the square to 12 on the other and it will measure $14.4 \div 12$ and obtain 1.2.

This method avoids mathematical calculations and is applicable to *any pitch*—6½ to 12, 6 to 12, or 5 to 12. Simply measure from one figure to another and divide by 12 for the factor.

In using the steel square it is advisable to use a rule which contains sixteenths, eighths and quarters to the inch on one side and having tenths to the inch on the other. This facilitates measuring with accuracy.

As the base of the triangle in Fig. 17 is 12 in., then $12^2+12^2+8^2=352$; $\sqrt{352}=18.76 \div 12=1.56$, the factor for obtaining the true lengths of hip bars for any size skylight having one-third pitch. These calculations can be omitted by using the steel square. Measure from 12 to 12 in Fig. 18 and obtain 17, the length of the hip line in Fig. 17. As the rise is 8 in. as shown, then measure from 8 to 17 in Fig. 18 and obtain $18\frac{13}{16}$ or $18.8125 \div 12=1.56$. Thus the only calculations required with the steel square is to divide the two hypotenuses by 12 as above described.

Let us now find the true lengths of the bars required to fabricate the skylight shown in Fig. 16. The following rules gives the *plan* measurements of the bars when a ventilator is used (I). From the *narrow* side of the frame deduct the width of the ventilator and divide by 2. Thus $42 - 6 = 36 \div 2 = 18$. Using the factor for the common bar previously obtained, then $18 \times 1.2 = 21.6$ inches, the true length of the 8 common bars shown, measured from the arrow points shown in the common bar pattern in Fig. 13. Using the same factor, 1.2, multiply this by 14, or the distance from the corner to the jack bar shown in Fig. 16; $14 \times 1.2 = 16.8$, the true length of the 8 jack bars, also measuring from the arrow points in the jack bar pattern.

Now, using the same *plan* measurements as in the common bar, multiply this by the hip bar factor: $18 \times 1.56 = 28$ inches, the true length of the 4 hip bars, measuring from arrow points in hip bar pattern.

If the skylight in question had no ventilator but only a ridge bar, then obtain the *plan* measurements by dividing 42 by 2 and obtain 21, which number is multiplied by the above factors as before.

To obtain the length of the ventilator, the following rule holds good, no matter what size the skylight or ventilator *width* may be. Deduct the shortest side of frame from the longest side and add the width of the ventilator. Thus $98 - 42 + 6 = 62$ inches measured from the arrow points in the vent-curb pattern in Fig. 13. When a ridge bar is required and no ventilator is needed, then simply deduct the short side from long side: $98 - 42 = 56$ inches, the length of the ridge for a skylight of the size shown in Fig. 16.

When a skylight has more than one jack bar, as shown in diagram X in Fig. 18, the length of the jack bar A would be 14×1.2 or 16.8 for one-third pitch. If the second bar B were also spaced 14 in., then double the length of A and obtain 2×16.8 or 33.6 for bar B. Should unequal spaced lights be placed, as

(*Continued on page* 98)

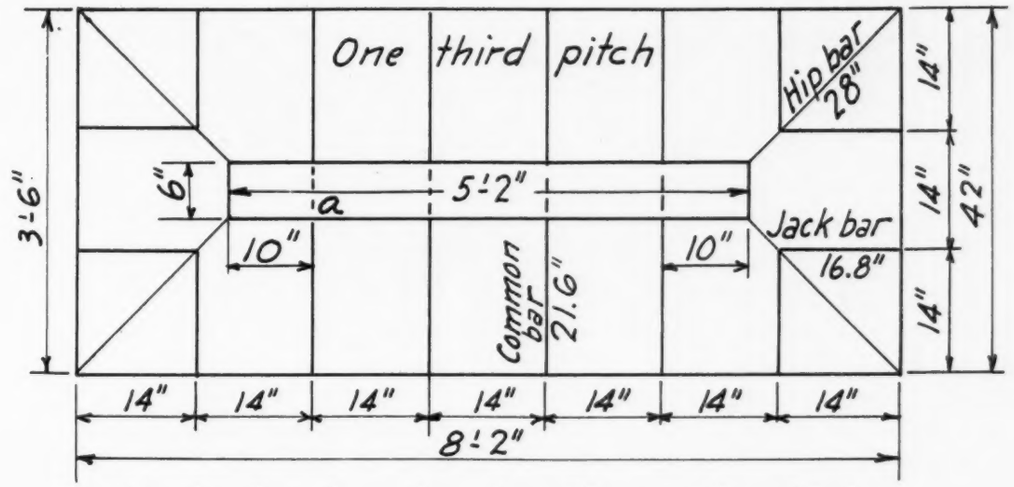


Fig. 16 - Finding true lengths of bars and ventilator

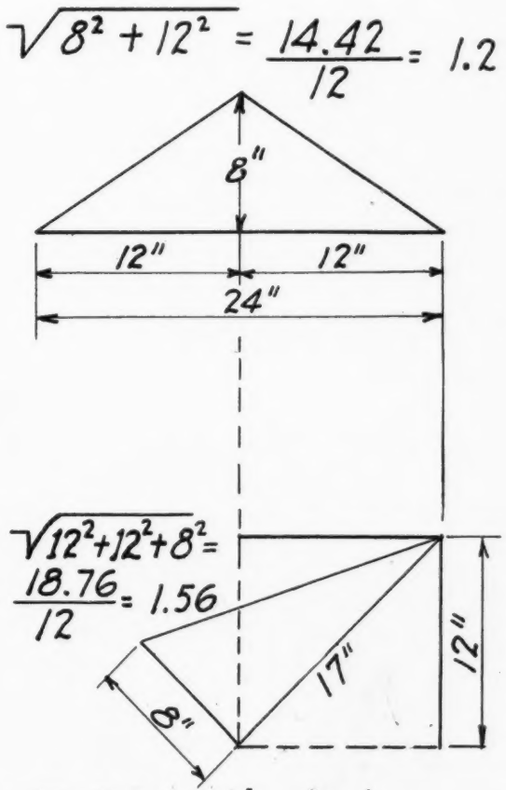


Fig. 17 - Calculating factors

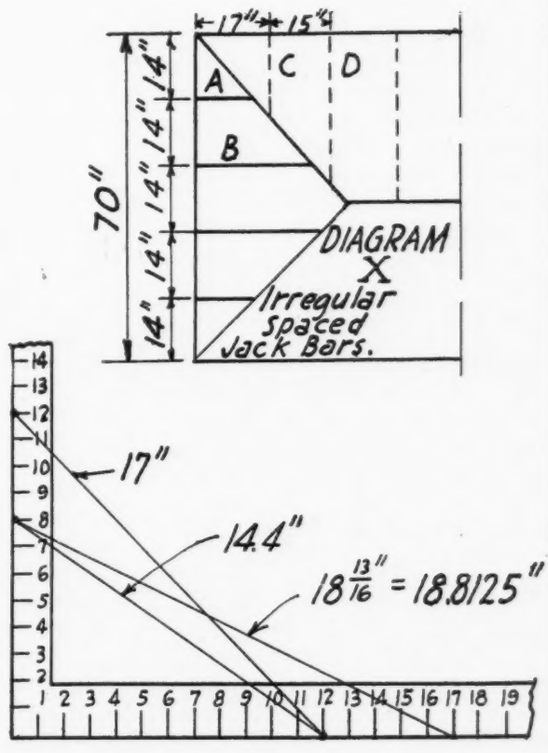


Fig. 18 - Computing with the steel square.

Better Weather Protection—Stucco

The recommendations presented in this series of illustrated reference sheets have been taken from various sources considered practical and authoritative. This article and the details opposite cover flashing applications for use with stucco on exposed surfaces subject to water penetration.

IN the last two articles in this discussion of better weather protection several methods for flashing around stucco have been presented. This article concludes the data covering stucco applications.

As pointed out in the other two articles, the importance of proper flashing where stucco is the exterior material cannot be too strongly stressed, due to the fact that any stucco exterior is a shell built on its own reinforcement and tied to underlying construction only by the nails which hold the reinforcing in place. Such construction, where the stucco abuts other materials or surfaces lying in other planes, affords ready entrance of water behind the stucco.

Heating men generally look carefully at the construction of any concrete masonry house because past experience has indicated that very poor laying up of the units is not at all uncommon, resulting in "leaky" walls. The sheet metal man applying flashing to a concrete masonry or stucco house should also examine the workmanship for the same reason.

Low Parapets

In the illustrations of recommended practices accompanying this article, we have used concrete masonry in five of the six details to bring out these features.

The detail in the upper left corner shows recommended practice for a parapet wall less than 24 inches high with an adjoining flat roof. The coping cap may be either concrete or stone. It is suggested that the coping through wall flashing be turned into a drip under the outside edge of the coping cap in order to divert water well down the stucco exterior. On the inside, the base flashing is carried up the entire height of the wall to underlie the through wall flashing at least 4 inches. Where possible, the base flashing should be continuous, as shown.

The upper right detail shows similar construction, but for a parapet more than 24 inches high and having a cornice or molding course. The through wall flashing under the cap ends a few inches down the inside wall, but the lap over the masonry should be generous, especially if stucco is used. A through wall flashing course beneath the cornice is recommended, with a water bar through the center, and if stucco is the exterior material a generous turndown edge over the wall. The inside of the through wall flashing can form the cap for the roofing on the cant block.

Roofs, Porch Floors

The left center detail occurs frequently. If the porch floor is exposed to water, care should be taken to provide a high flashing at the junction, using a block to bring the flashing out flush with the face of the stucco to eliminate water passage under the edge of the stucco shell.

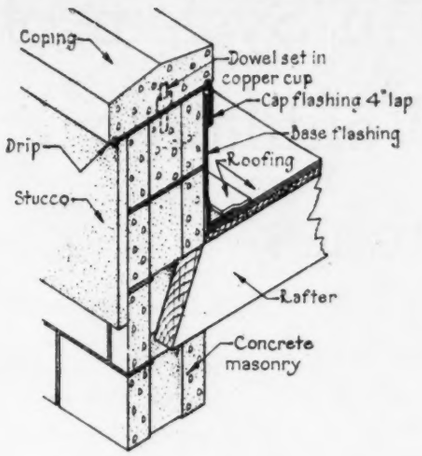
Where stucco on concrete masonry stands above a sloping porch roof as shown in the right center detail, carry the cap flashing up and into the first masonry joint. Again be sure that a block is built in to bring the cap flashing face flush with the stucco face and provide at least 4 inches of lap over the base flashing, which is standard construction.

In some localities belt and soldier courses are frequently omitted just above the grade level, which practice may not be especially serious with some materials, but with stucco such construction leaves a free hanging and unprotected edge at the bottom of the stucco. As shown in the lower left detail, this edge should be protected with a metal flashing sunk into the masonry joint at the edge or the first joint above the edge and formed to stand straight out beyond the face of the stucco and turned down to make a drip over the foundation.

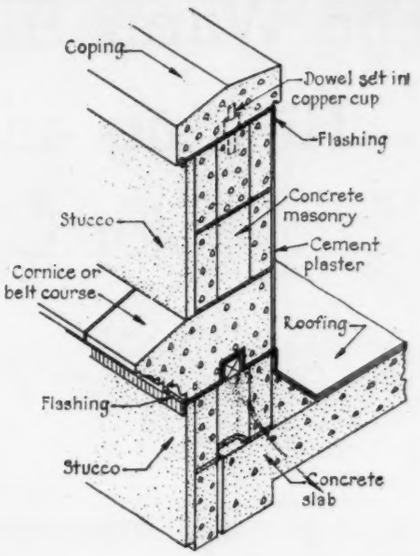
Belt Courses

Masonry or concrete belt courses where such occur to break the stucco exterior or form the bottom of the stucco exterior will always have a masonry joint directly behind the edge of the stucco. Unprotected water flowing down the stucco works under the edge and, finding a masonry joint at the same place, can penetrate the wall if the blocks are poorly "buttered." This construction is a very frequent cause of stucco trouble. The sheet metal contractor should be careful to examine every stucco covered structure for such construction and, where found, should exercise extreme care to provide a flashing course (through wall if possible) and, if not, then an application as good as the detail in the lower right.

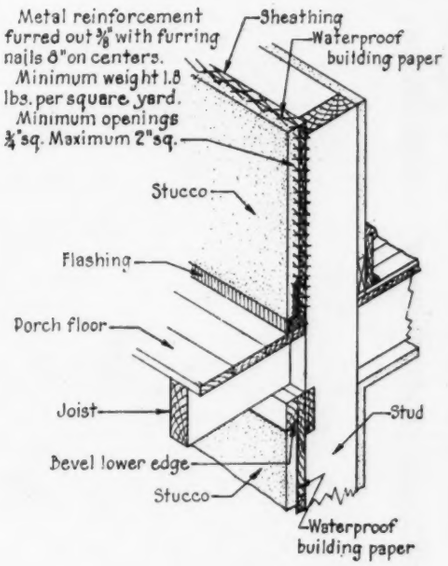
If the belt course does not form a drip, call the owner's attention to a bad piece of design.



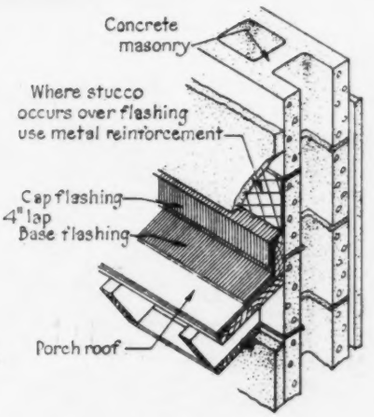
DETAIL OF FLASHING COPING AND PARAPET WALL LESS THAN 24" HIGH



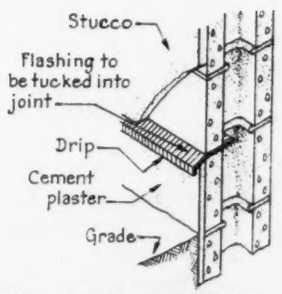
DETAIL OF FLASHING FOR CORNICE, COPING AND PARAPET WALL HIGHER THAN 24"



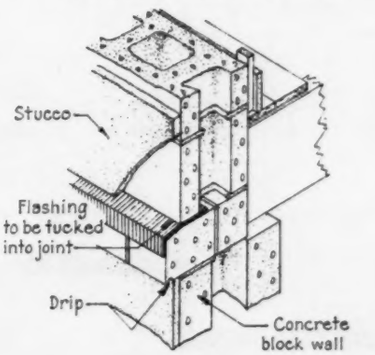
FLASHING USED WHERE PORCH FLOOR ABUTS A STUCCO WALL



DETAILS OF FLASHING WHERE PORCH ROOF ABUTS CONCRETE MASONRY WALL



METHOD OF STOPPING STUCCO WHERE NO BELT COURSE OR SOLDIER COURSE IS PROVIDED



DETAIL OF FLASHING WATERTABLE OR BELT COURSE

[Details of recommended flashing applications for exposed surfaces covered with stucco. Drawings by Portland Cement Assn., Chicago]

The Warm Air-Fan System of Heating and Ventilating for Churches

By Platte Overton

Chief Engineer, The Furblo Co.

In the November issue the author explained how the data sheet is calculated and arranged. In this article the problems of using one register temperature, temperature drop, frictional resistance and air movement are discussed.

◆

ONE of the many problems in church heating is caused by high ceilings and where balconies occur it is important that we design the system to prevent overheating on this level. As mentioned previously, this is best accomplished by supplying a large volume of air at as low a register temperature as possible. We should not consider anything less than a 10-minute air change in this auditorium. As we find on our data sheet that the cubic feet of space is 108,000, we divide this by 10 and have 10,800 c.f.m. For our register temperature we have

$$\frac{\text{B.t.u. loss}}{10{,}800 \times 1.07} \times 70 = 101.4$$

degrees approximately.

One Trunk—One Temperature

We have only one trunk duct, so it is obvious that we can have but one register temperature. However, the temperature of the air in this trunk line will drop due to the B.t.u. loss through the metal. The duct is about 120 feet long and the temperature drop will vary, but we can assume a loss of 20 degrees between the plenum chamber and the far end of the trunk line. For such a low temperature loss as 20 degrees in 120 feet we must maintain a fairly high velocity of 1000 to 1200 feet per minute. For an average register temperature in the auditorium of 101 degrees our duct temperature at the heaters will be about 120 degrees and at the far end from 90

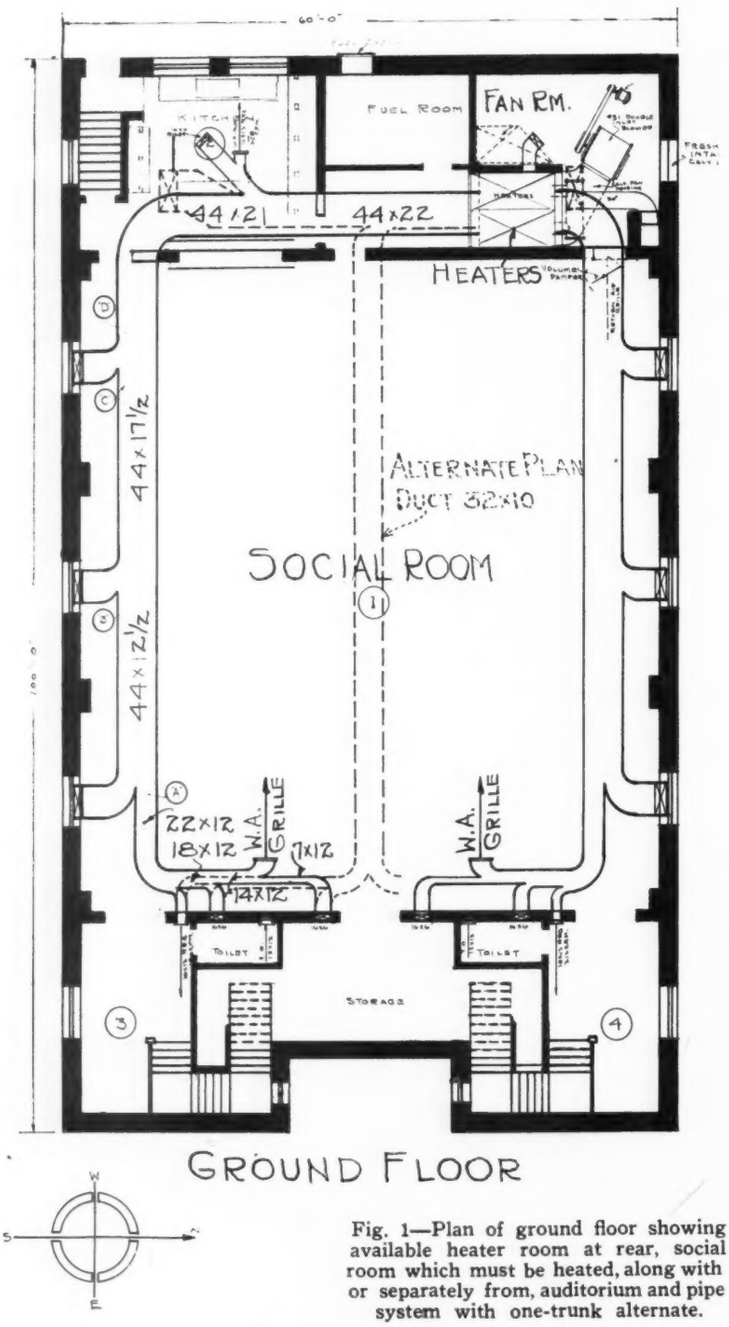


Fig. 1—Plan of ground floor showing available heater room at rear, social room which must be heated, along with or separately from, auditorium and pipe system with one-trunk alternate.

Table B
HEAT AVAILABLE IN AIR AT VARIOUS REGISTER AND ROOM TEMPERATURES

B. T. U.'s given up by 1 cu. ft. of air cooling from discharge outlet temperature to temperature inside building.

Temperature Inside Building	REGISTER TEMPERATURE													
Degrees F.	180	170	160	150	145	140	135	130	125	120	115	110	100	90
80	1.474	1.348	1.218	1.082	1.015	0.944	0.872	0.800	0.726	0.651	0.574	0.497	0.337	0.172
70	1.622	1.499	1.370	1.238	1.170	1.101	1.032	0.960	0.887	0.814	0.738	0.662	0.505	0.343
65	1.696	1.573	1.447	1.314	1.248	1.180	1.110	1.040	0.968	0.895	0.831	0.745	0.598	0.428
60	1.770	1.649	1.522	1.392	1.325	1.258	1.190	1.120	1.049	0.977	0.903	0.828	0.674	0.514
55	1.844	1.723	1.599	1.470	1.404	1.336	1.270	1.200	1.129	0.158	0.985	0.911	0.758	0.601
55	1.918	1.798	1.575	1.547	1.481	1.415	1.348	1.280	1.210	1.138	1.068	0.994	0.843	0.686

to 100 degrees. Hence our rooms on the East will be figured at 100 degrees register temperature and the choir room, hall and kitchen at 120 degrees.

We refer to the Table B and select the factor by which we determine our cfm. To use Table B find room temperature at left, move right to register temperature column and read factor. Multiply this factor by 60 and divide the result into the B.t.u. loss in item 22.

Heating Social Room

For our social room we have placed the warm air register on the far end of the trunk duct. At times this room will be used for social gatherings and will require heat, while the upper floor is not used. For this purpose we place cut-off dampers in the two main supply ducts near the heaters, and heat this social room through a warm air register placed directly in the plenum chamber wall between the heaters and the room. This opening is shown in Fig. 6. When both floors are being used simultaneously this register is closed and the room heated from the register at the far end of the trunk line. The register temperature will be low, but the trunk lines pass through this room and the heat loss from these ducts help to heat this social room. Thus we will assume a register temperature of 120 degrees for this area regardless of which end of the system the air is delivered from.

Rooms 3, 4, 104, 105, 106, are on the far end of the trunk duct with an average register temperature of 100 degrees. These register temperatures are noted on the data sheet in Item 27. Thus the cfm. in Item 25 is Item 22 divided by the factor in Item 33. As stated, this factor is taken from Table B.

Table B, above, is much used by experienced heating engineers to determine the cfm. The text explains just how to use the table.

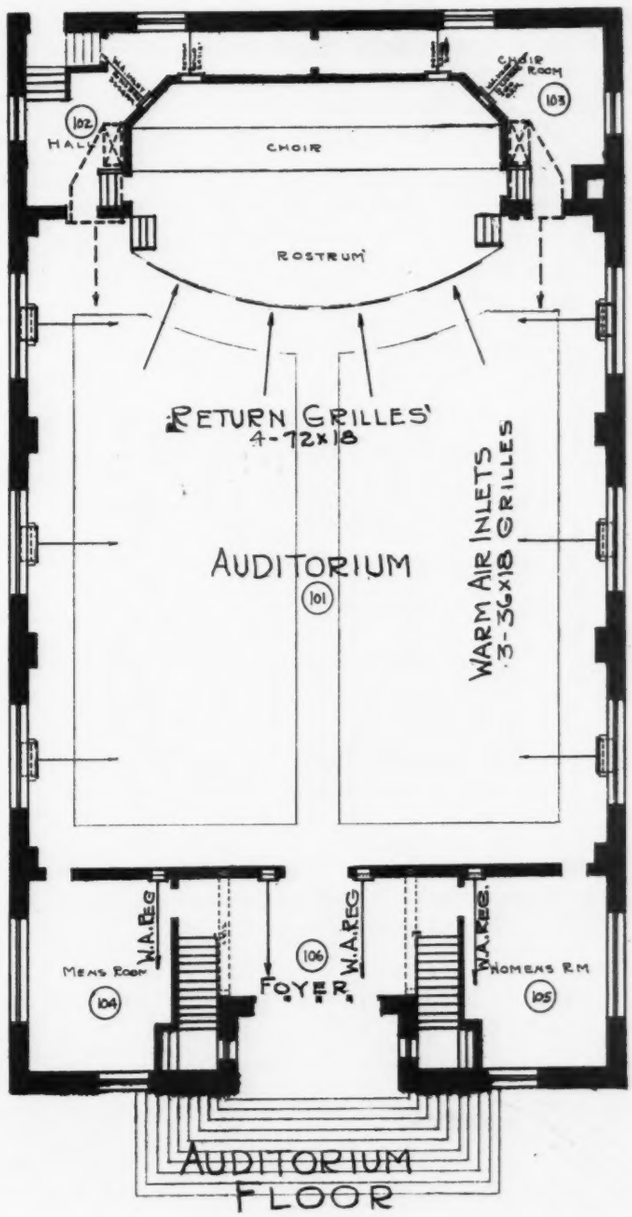
◆

Fig. 2—Plan of auditorium showing cloak rooms to be heated, balcony above foyer, rostrum, location of distribution system.

Registers

Warm air registers are arranged as shown on the plans. Our cfm. is shown on the data sheet and we are ready to design and size the piping system. We will design our duct system to a pressure loss of .15 inches of water. Our intake loss at the fan and in the fan room will be low or about .05 inches. .15 minus .05 equals .10 for our supply ducts.

Our supply duct is 120 feet long with 4 elbows for which we add 10 feet each or a total of 160 feet. Referring to the standard friction chart for determining resistance of air ducts, we find the chart reads in ducts 100 feet long. Hence, we have .10 divided by 160 equals .0625 for our point at the base of the chart.



DATA SHEET

N 35 % NW 35 % NE 30 % W 30 % E 20 % SW 20 % SE 10 % S 5 %

Exposure Factors

Based on -10 °F. Cold Weather & Prevailing Winds From N.W.

Bldg. Church Date

Dist No.

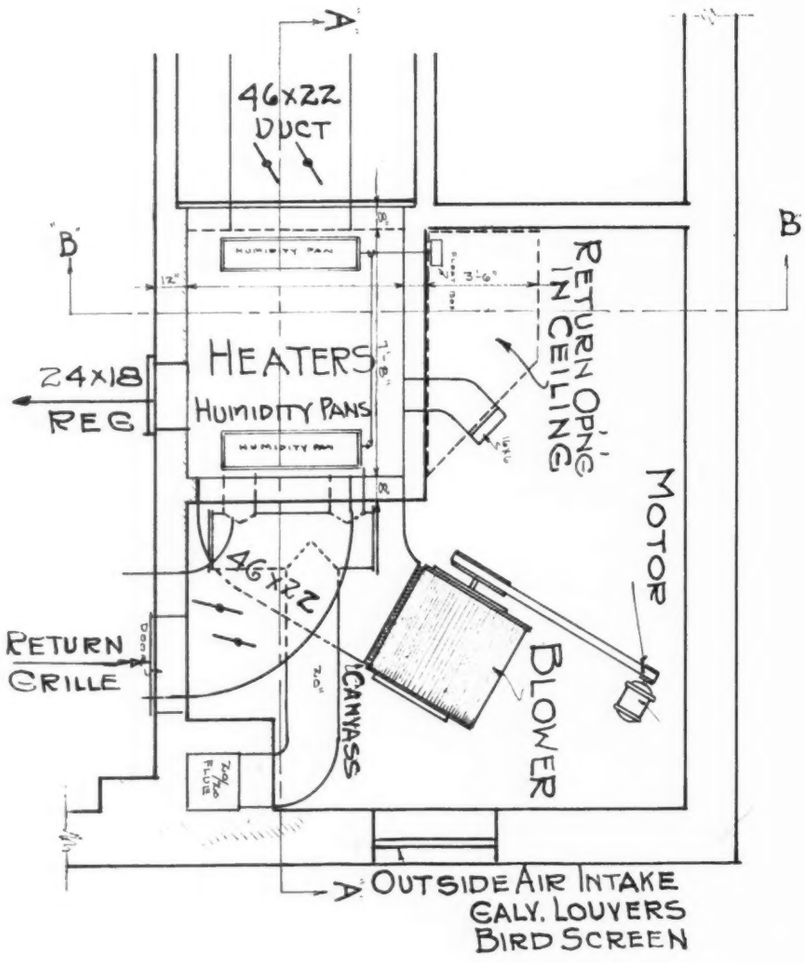
or Loc. Twp. Co.

Bldg. H. & V.

Archt. Engr.

	Rooms No.	1	2	3	4	101	102	103	104	105	106	Totals
	Use	Social	Kitchen	Hall	Hall	Audit.	Hall	Choir	Men	Women	Foyer	
MEASUREMENTS		56x60	16x18	11'x18'	11'x18'	56'x60'	9'x16	9'x16	14'x18'	14'x18'	27'x13'	
1. Room Dimensions		x11'	x11'	x11'	x11'	x23'	x9'	x9'	x9'	x9'	x9'	
2. Cubic Feet Space		36960	3168	3078	3078	105800	1296	1296	2268	2268	3159	
3. Room Floor Area		3360	288	198	198	3360	144	144	252	252	351	
4. Floor Const. & Factor						26-251						
5. Ceiling Const. & Factor						12-115.8						
6. Window Const. & Factor		12-96	12-96	12-96	12-96	12-96	12-96	12-96	12-96	12-96	12-96	
7. Wall Const. & Factor		.221-18.16	.221-18.16	.221-18.16	.221-18.16	.221-21.9	.221-18.16	.221-18.16	.221-18.16	.221-18.16	.221-18.16	
8. Exposed Sash and Door Perimeter, equiv.		132	32	16	16	288	16	32	16	16	82	
9. Leakage B. T. U. per ft. of Perimeter		100	100	100	100	100	100	100	100	100	100	
10. Expd. Wall Gross Area		1254	196	675	675	4320	891	540	270	270	121	
11. Expd. Window Gross Area		120	36	20	20	360	90	90	40	40	84	
12. Expd. Wall Net Area		1134	160	655	655	3960	801	450	230	230	37	
13. Exposure Direction		S & N	W.	S.E.	N.E.	N.E.S.W.	S.W.	N.W.	S.E.	N.E.	E.	
14. Room Temperature		70°	70°	70°	70°	70°	70°	70°	70°	70°	70°	
HEAT LOSSES												
15. Wall Loss B. t. u. per Hr.		15495	2706	3473	3473	74679	4376	5811	4116	4176	1580	
16. Window Loss B. t. u. per Hr.		11520	3456	1920	1920	165318	1920	3840	3840	3840	8064	
17. Subtotal Loss B. t. u. per Hr.		26665	5662	5393	5393	180057	6296	9651	8016	8016	9644	
18. Expos. Allow. B. t. u. per Hr.		3553	1648	534	1617	36011	1255	3480	801	2400	1533	
19. Floor Loss B. t. u. per Hr.						126504						
20. Ceiling Loss B. t. u. per Hr.						28800						
21. Leakage Loss B. t. u. per Hr.		13200	4700	1600	1600	37372	1600	3200	1600	1600	8000	
22. Total Heat Loss		45558	11560	7532	8610	14466	9155	16331	10417	12016	19597	
23. Deduct for Heater Size		6600	2100	800	800	356972	800	1600	800	800	4800	
24. Heater Building-loss Load		38958	9460	6732	7810	83555	8355	14731	9617	11216	15597	473448
SERVICE												
25. Air Supply C. F. M.		930	240	250	285	10800	188	335	345	400	650	14423
26. Recirculation C. F. M.		862				10022	174	311				11369
27. Air Supply Inlet Temp.		120	120	100	100	1014	120	120	100	100	100	
28. Air Supply B. t. u. Service												
29. Direct Radn. B. t. u. Service												
30. Direct Radn. sq. ft.												
31. Grav. Ind. Radn. sq. ft.												
32. Aspir. Coils Radn. sq. ft.												
33 factor page		4896	4896	30.3	30.3		4896	4896	30.3	30.3	30.3	

Fig. 4—This data sheet will be used for all the types of large structures discussed in this series. The needed information is arranged so that any one complete item can be seen for all rooms or any total of items can be found quickly.



Our system has two supply ducts each, with the same c.f.m. approximately and we have 14,423 c.f.m. (see Item 25 total) divided by 2 equals 7,211 c.f.m. Locating .0625 at the base of the chart we move up this line until we intersect with the 7211 c.f.m. from the right hand side of the chart, and find a 34-inch round pipe with a velocity of a little over 1,000 feet per minute.

Our duct on one side of the church will be shorter and have less pressure loss, and theoretically should be made a little smaller, but we will make it the same size and install volume dampers. This is done for the reason that it will cheapen the shop work and pattern cutting when the ducts are constructed alike.

(To be continued)

Fig. 6—Arrangement of apparatus in heater room. The entire room acts as a gathering chamber for return air. The register for the social room is at the left, center.

Indiana Furmets

The Furmets of the Indiana Sheet Metal, Warm Air Heating and Roofing Contractors Association have selected the Hotel Antlers as the place for the annual Furmet banquet and dance.

The annual Furmet business meeting will be held at 10.00 A. M. on Monday, January 20 in the Antlers Hotel.

These arrangements are being made because the convention and exhibits will be held in Tomlinson Hall downtown where suitable space for a banquet and dance are not available.

George C. Joslin,
Secretary.

◆

NWAH and ACA Convention

The National Warm Air Heating and Air Conditioning Association, 50 West Broad Street, Columbus, Ohio, is distributing the program for the 23rd annual convention to be held at the Stevens Hotel, Chicago, on December 15, 16 and 17.

On Tuesday, December 15, there will be meetings of the board of directors and committees. The program proper begins on Wednesday with a call to order and announcements by the president, W. L. Rybolt, chairman of the session, followed by a talk, "Through Your President's Glasses." Other speakers and subjects follow:

Bennett Chapple, Middletown, Ohio —"What an Opportunity."

Dana W. Norris, Syracuse, N. Y.— "What Shall It Profit Us?"

Oliver Gedeist, Dowagiac, Michigan —"New Merchandising Methods Needed for the New Heating Era."

Hon. Arthur P. Lamneck, Columbus, Ohio—"The Robinson-Patman Act."

On Wednesday the following speakers and subjects are scheduled:

Prof. J. D. Hoffman, Committee Chairman, Purdue University—"Our Installation Codes."

F. G. Sedgwick, Minneapolis, Minnesota, Chairman, Research Advisory Committee Report.

A. P. Kratz, Research Professor, University of Illinois, Urbana—"The Calculation of Cooling Load for Installation of Summer Cooling Systems."

S. Konzo, Special Research Associate, University of Illinois, Urbana —"Summer Cooling in the Research Residence Using Water at 52 deg. F. and 46 deg. F."

The Thursday morning session will have the following speakers and subjects:

Frank G. Herman, Oshkosh, Wisconsin—"Combined Salesmanship and Engineering Imperative."

Frank L. Myers, Toledo, Ohio— "Servicing Today a New Problem."

C. D. Leiter, Ashland, Ohio—"Summer Cooling Using Well Water."

At 11:30 there will be a report of the Board of Directors, election of officers, new and unfinished business with final adjournment at 1 p. m.

Allen W. Williams,
Managing Director and Treasurer.

◆

Detroit

The second monthly meeting of November was held in the Hotel Detroiter by members of the Detroit Association of Warm Air and Air Conditioning Contractors on November 16. Plans for activities during the coming winter were explained to new members and guests by the officers.

Membership applications, which have been prepared in mimeograph form were passed out for discussion. The association proposes to apply dues according to the volume of yearly business done by each member—those doing the most business to pay the highest amount. This procedure has met with favor from the members. Whether or not manufacturers' representatives and manufacturers or their employees shall be included as full members with full voting power remains to be decided.

The secretary has begun an intensive personal drive to enlarge membership, assisted by officers and a membership committee.

At this meeting J. D. Wilder, editor, American Artisan, outlined the activities of some of the other state and local associations and answered questions from members relating to various plans our association has under consideration, supplying answers by means of reports from other active groups.

The association is inviting all Detroit contractors to attend and join. Meetings are held the first and third Monday evenings of each month in the Hotel Detroiter.

N. J. Biddle,
Secretary.

◆

Chattanooga

Frank Merrick, of Louisville, Kentucky, past president of the National Association of Sheet Metal Contractors, spoke before the Chattanooga Subcontractors Association on November 5. He said that "the law of the jungle is destruction. Competition is necessary but it should not be cutthroat competition. It should be cooperative competition." He admonished associations to raise the standards of competition.

The gathering of sixty subcontractors was held at the Hotel Patten and was also addressed by J. C. Snyder of Louisville, secretary of the Louisville Builders Exchange; J. L. Farrar of Nashville, secretary of the Nashville Contractors Association; R. Edenfield, vice president of the Nashville association; and Wm. Parks, president of the contractors' organization in the state capital and president of the Tennessee Painters Association. The officers of the newly formed Chattanooga Subcontractors Association are: August Lee, president; P. Marcus, vice president; R. L. Brooks, treasurer; and J. R. Wilcox, secretary-manager.

◆

Ohio

The Ohio State Annual Sheet Metal Convention will be held at the Carter Hotel, Cleveland, on March 16, 17 and 18, 1937.

The officers of this state association are D. A. Mannen, president; Wm. Lauer, vice president; Carl Gundlach, secretary; and W. E. Feiten, treasurer.

The organization set up to handle the Cleveland convention consists of: Chairman of convention committee, W. E. Feiten; secretary and treasurer, M. J. Cutter; chairman of finance committee, Jos. Hagan; chairman of entertainment committee, Milton Thesmacher; chairman of publicity committee, George Halter; chairman of program committee, D. A. Mannen.

C. L. Moseley,
5005 Superior Avenue, Cleveland.

Association Activities . . . . .

Galvanizers Organize

A new permanent organization, The Galvanizers Committee, definitely allying technical groups in the steel and zinc industries, is the result of a meeting held in Pittsburgh in November at which representatives of over twenty companies were present.

The close relationship of the galvanizing departments to the zinc industry led to the adoption of a plan whereby the American Zinc Institute assumes the sponsorship of the new organization, the president and secretary of the Institute to be ex-officio members. The affairs of the group will be administered by a council, consisting of one individual from each company represented in the membership, and a governing board of seven chosen from the council. Two meetings will be held each year, one in conjunction with the Annual Meeting of the Zinc Institute in April, the other in the fall at some place to be determined.

The members of the Organizing Committee which arranged for the November meeting were elected to the governing board for the ensuing year. They include F. G. White, Granite City Steel Company, chairman, who will continue as chairman of the Galvanizers Committee; G. A. Brayton, Newport Rolling Mill Company; F. W. Brown, Inland Steel Company; N. E. Cook, Wheeling Steel Corporation; B. P. Finkbone, American Rolling Mill Company; H. E. McCoy, Gulf States Steel Company; J. L. Schueler, Continental Steel Company.

Howard I. Young, President of American Zinc Institute, is ex-officio member, as is also E. V. Gent, Secretary of the Institute, who was elected secretary-treasurer of the new group.

E. V. Gent,
Secretary.

◆

Milwaukee

The Master Sheet Metal, Heating, Ventilating and Air Conditioning Contractors Association of Milwaukee, Wisconsin, held their monthly meeting on Monday evening, December 7, at the Guild Hall, Republican Hotel, Milwaukee, for the consideration, discussion and disposition of such matters and problems which may be called to the attention of the members.

These are new quarters for the association. Lunch and refreshments were served after the meeting as a sort of a "Get-Together-Affair."

Nomination of members of the Board of Directors for the year 1937 took place and the election of nine of the nominees were given consideration at that time.

Paul L. Biersach,
Secretary.

Convention Dates

Sheet Metal Contractors Assn. of Wisconsin—February 1, 2, 1937—Republican Hotel, Milwaukee.

Sheet Metal Contractors Assn. of Ohio—March 16, 17, 18, 1937—Carter Hotel, Cleveland.

Sheet Metal and Warm Air Heating Contractors Assn. of Indiana—January 19, 20, 21, 1937—Lincoln Hotel, Indianapolis.

American Society of Heating and Ventilating Engineers—January 25, 26, 27, 1937—Hotel Statler, St. Louis, Mo.

National Assn. of Sheet Metal Distributors—May, 1937, Cleveland.

National Oil Burner and Air Conditioning Exposition—March 15-19, 1937, Philadelphia.

Indiana

The Sheet Metal, Warm Air Heating and Roofing Contractors' Association of Indiana with headquarters at 631 So. Delaware Street, Indianapolis, is preparing for the biggest convention they have ever had. The committee has planned an exceptional program and exhibit, in charge of Guy A. Voorhees.

The convention and exhibit will be held in the auditorium of Tomlinson Hall. The necessity for increased exhibit space has been indicated by the interest evidenced by exhibitors and by the number of developments and refinements brought to the industry since the last exhibit. The committee is desirous that all manufacturers who have achieved marked advances during the past year shall have an opportunity to display and demonstrate them.

The booth sale is in charge of the Furmets, which organization has been responsible for the banquet and entertainment which has featured every past Convention. Any financial profit derived from the booth rentals will be turned over to the Furmet organization to be used by them for the entertainment of the Convention visitors. President Chas. McManama of the Furmets is cooperating with President Huncilman of the Contractors Association to put over the most creditable Convention in all respects.

The Convention will open on Tuesday, January 19th, and will close with a banquet Thursday night, January 21st.

Paul R. Jordan,
Executive Secretary.

Michigan

Michigan Sheet Metal & Roofing Contractors Association, Association of Commerce Building, Grand Rapids, Michigan, will hold its annual convention at the Pantlind Hotel, Grand Rapids, on March 2, 3 and 4.

◆

Chicago

The Master Furnace & Sheet Metal Association, Chicago, has an Educational Committee very hard at work solving ways and means of interest to members. The association meets at Universal Sportsman's Hall, 7435 Cottage Grove Avenue, Chicago, on the first and third Monday of each month, with a speaker once a month—the topic to be air conditioning, ventilation, cost accounting, bookkeeping, and various subjects with reference to the furnace and sheet metal business.

At the first meeting in December there will be the election of officers.

All members report that they are quite busy and in some cases would like to get some assistance.

John Titterington,
Secretary.

◆

Cleveland

The Warm Air Furnace and Air Conditioning League, Inc., Cleveland, made up of progressive furnace and air conditioning contractors, has met every Monday for the past two years, except when a holiday fell on Monday.

Under the guidance of their worthy president, N. A. Schill, the league has accomplished many things which benefit the industry. A fair price for furnace operations has been established through continued advertising and cooperation with all Cleveland newspapers and shopping papers. These papers will not accept an ad with a price under $4.00 for furnace cleaning, or under $12.00 for a reset. The cleaning of the hot air pipes is a dollar a pipe extra. The Better Business Bureau is working with the association in this matter.

The jobbers and manufacturers with two exceptions are refusing to make sales to other than established dealers. The association has the moral and financial backing of all the furnace manufacturers and sheet metal jobbers.

There was a course in salesmanship which was open to the entire trade. The talks were given by sales engineers from some of the large Cleveland corporations. They are now presenting to the shop owners of Cleveland a second course in air conditioning, with Professor C. A. McKeeman of Case School of Applied Science as instructor.

The program for 1937 is in the planning.

T. W. Hutton,
Secretary.

RESIDENTIAL AIR CONDITIONING SECTION

ABOUT this time every year home owners begin to ask —"Just what can I do to reduce my fuel bill?" The contractor familiar with available information will quote test data to show how much is saved by storm sash, by weather stripping, by ceiling insulation, by wall insulation and combinations of these helps.

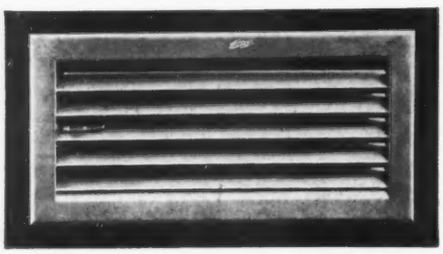
- - - But there may be some contractors not familiar with these data and for their benefit we publish the first part of an article showing just how much is saved by percentage and by actual Btu loss reduction.

- - - Every time we visit a town we are surprised at the number of readers selling stokers. These men should be interested in underlying data which enables them to answer owner questions. "Coke trees" are one such phenomenon. The explanation and what to do about it is in this section.

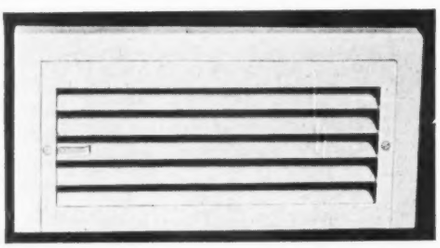
- - - We also wish to call readers' attention to the announcement of the sixth Michigan State College Short Course in heating. This year's program is more than usually complete.

WATERLOO

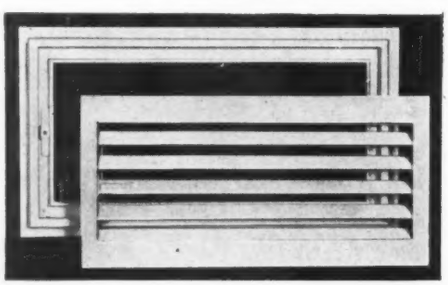
Air Conditioning REGISTERS



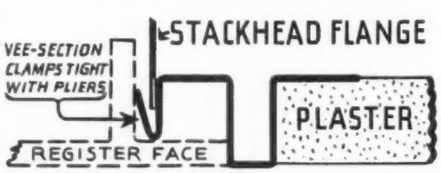
FH-100—Adjustable one-piece Venetian Type Register for walls.



FHD-204—Two-piece Venetian type adjustable register for baseboards.



FH-102—Venetian Type adjustable register for walls, with Vee-U plaster frame.



The Waterloo Vee-U Frame assures positive, tight connection with stack-head.

On to Greater Profits in 1937

....with Waterloo's outstanding "Register of Tomorrow"....

Advanced styling, modern straight-line simplicity, and rich distinctive beauty set Waterloo's new "Venetian Blind Effect" registers apart from every other register on the market. No wonder the entire heating industry is hailing them as a "sales natural." For, in addition to their striking smartness, these registers offer such exclusive structural superiorities as—

Slanted louvres that reflect light and color, conceal the ducts—Complete adjustable control of air flow (90-degree range) — Positive lock mechanism — Tested capacities.

WATERLOO REGISTER CO.

Floor Registers . . . Floor Cold Air Faces . . . Baseboard Gravity Registers . . . Wall Registers . . . Oakwood Faces . . . Steel Grilles . . . And All Furnace Supplies

Waterloo, Iowa • Seattle, Wash.

In New York City—Air Conditioning Utilities, Inc., 8 W. 40th Street.

In Los Angeles, California—Waterloo Register Co., 824 Clanton Street.

Investigate! Mail Coupon NOW.

Address Nearest Office or Agency

Waterloo Register Co., Waterloo, Ia.

Send new catalog of Waterloo Registers, with new designs, new charts and installation data—without obligation.

Name .....

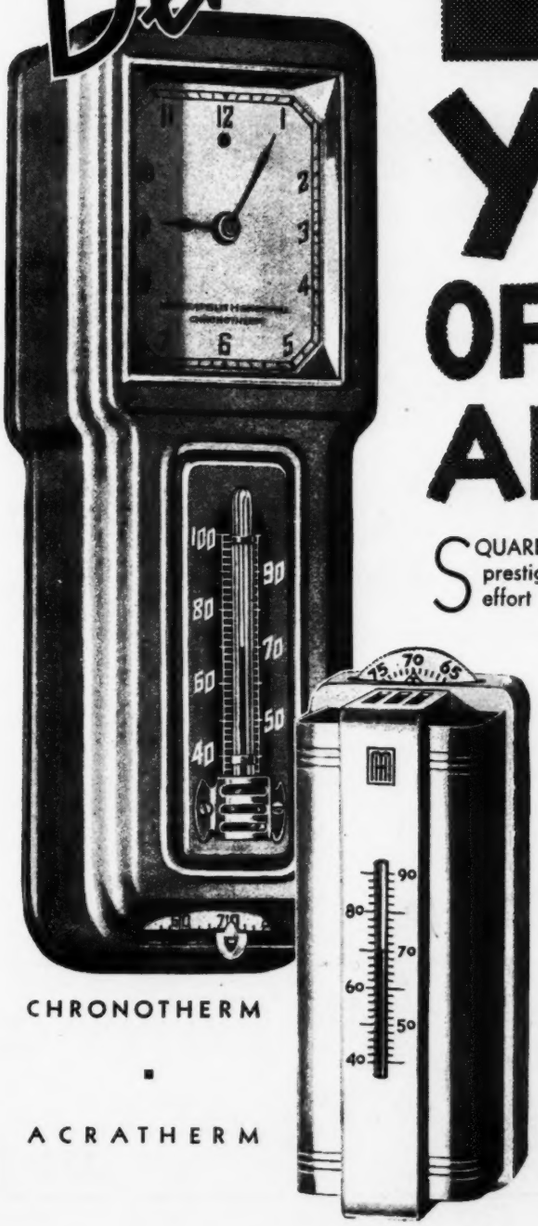
Firm .....

Address ..... State .....

City .....

Behind these 50 Controls

50 YEARS OF NATIONAL ADVERTISING



CHRONOTHERM

•

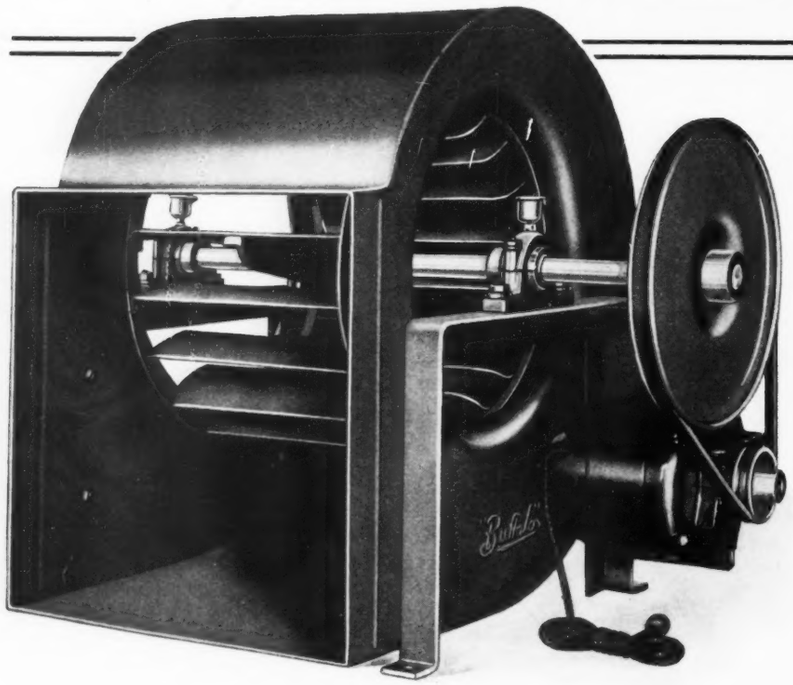
ACRATHERM

SQUARELY back of every Minneapolis-Honeywell control stand the prestige and public acceptance gained by half a century of continuous effort in the advertising columns of nationally known magazines and newspapers. This year alone more than 76,000,000 separate messages each urging the installation of Automatic Heat and Air Conditioning, have appeared in such magazines as The Saturday Evening Post, Collier's, Time, Business Week, Nation's Business, American Home, House and Garden, House Beautiful and The New Yorker. Millions more similar messages have appeared in leading newspapers from coast to coast. Such effort is productive for more automatic heating installations for you. During this same 50 years, the Minneapolis-Honeywell Engineering and Research laboratories have continuously pioneered and developed control improvements to greatly facilitate the sale of automatic heat. Minneapolis-Honeywell controls are a stamp of approval for your automatic heating equipment. Minneapolis-Honeywell Regulator Co., 2726 4th Ave. So., Minneapolis, Minn. Branch and distributing offices in all principal cities.

MINNEAPOLIS HONEYWELL

Control Systems

BROWN INSTRUMENTS FOR INDICATING, RECORDING AND CONTROLLING



Can you afford NOT to sell this fan?

Your business depends on satisfying your customers. If you are installing forced warm air heating, or air conditioning, the most important part of the installation is the fan. Because it must deliver air up to rated capacity against varying resistances—the fan must be accurately rated. Because it must stand rough handling without damage, it must be sturdy. And finally, and most important of all, IT MUST BE QUIET!

We know that you can prove to your own satisfaction that Buffalo HVA Fans are the most satisfactory when checked against these three important requirements.

Two Sizes—For Immediate Shipment

Now they are available with a new rubber-cushioned noise isolating motor mounting, shown above. Moderately priced for the quality of the fan, these motor driven units will help you sell more jobs.

Write today for Bulletin 3044 and your prices.

Buffalo Forge Company

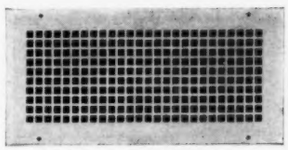
497 Broadway Buffalo, N. Y.

In Canada: Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo" Type "H.V.A." Forced Circulating Fans

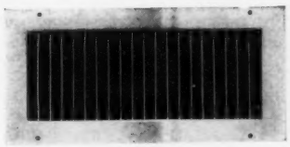
For 1937 H&C Presents A Most Comprehensive Line of AIR CONDITIONING GRILLES and REGISTERS

8 OUTSTANDING DESIGNS



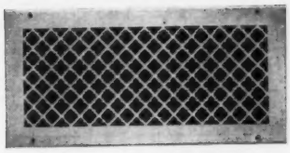
NO. 71 DESIGN †

A low-priced attractive grille. Small openings (⅜") afford excellent concealment of duct—improve appearance. Price Group A



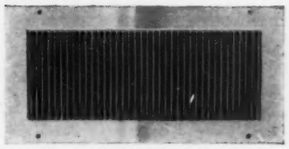
NO. 72 DESIGN †

Combines bar type construction, neat appearance, unusually large free area with low cost. Depth of bars is ⅜". Price Group A



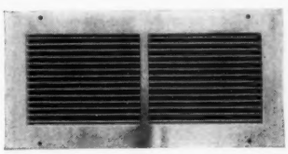
NO. 76 DESIGN

Inexpensive — A favorite with many because of its attractive appearance which harmonizes with any interior. Price Group B



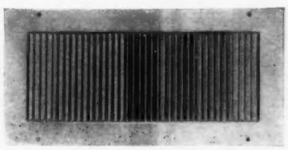
NO. 77 DESIGN †

Made up of bars ⅜" in depth spaced ⅜" apart. Affords neat appearance, effective concealment of duct at very modest cost. Price Group B



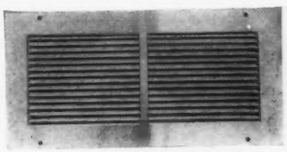
NO. 78 DESIGN †

Similar construction to No. 77 except bars are horizontal. Center mullion further enhances appearance. Price Group B



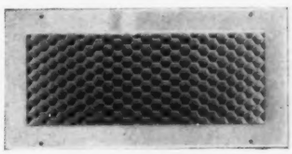
***NO. 84 DESIGN †**

Adjustable bar type. Provides,—easily and quickly any deflection or combination of deflection desired. Price Group D



***NO. 85 DESIGN †**

Similar in construction to No. 84. Downward adjustment of the bars when located near the ceiling avoids streaked ceilings. Price Group D



NO. 90 DESIGN

Recognized as the ACE of A. C. Grilles. Gives dual control of air-flow. Depth and curved tubes reduce noise, turbulence, resistance to minimum. Price Group E

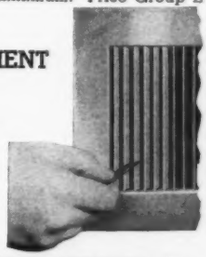
† *New item—Ready in January.*

IN 4 PRICE GROUPS

The four price groups in which H & C grilles are offered, together with the latitude afforded in the selection of frames, permit unprecedented flexibility in meeting the exact requirements of every installation. By all means use this great line in 1937; and be sure to ask your jobber for a copy of the new H & C No. 37 Complete Catalog, just off the press.

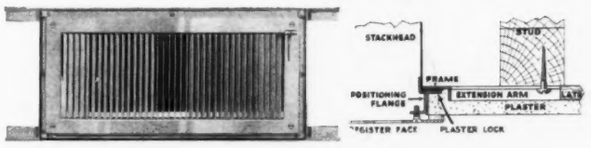
SECTIONAL ADJUSTMENT

*Bars are adjusted in 2" sections by means of key provided. Hence in even a 10" grille as many as 5 different deflections may be made.

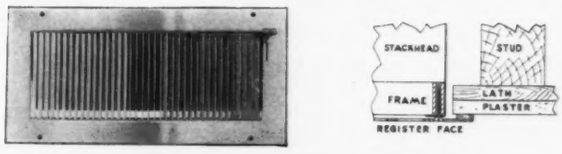


ALL AVAILABLE with 1 or 3-PIECE FRAMES

FOR SIDEWALL OR BASEBOARD INSTALLATION — INTAKES TO MATCH



3-PIECE SIDEWALL TYPE WITH NO. 84 DESIGN



1-PIECE SIDEWALL TYPE WITH NO. 84 DESIGN

HART & COOLEY MANUFACTURING CO.

Warm Air Registers Regulator Sets H&C Air Conditioning Grilles Dampers · Chain

61 W. KINZIE ST. · CHICAGO · ILLINOIS

In Canada: Fort Erie N., Ontario

TWO-ELEVEN ROOM THERMOSTAT

Artistically styled, sensitive and dependable, the Two-Eleven is available either with or without compensation (preheater)—both types in all models for heating, cooling, night and day, summer and winter and for three-wire circuits.

"GENUINE DETROIT" HUMIDISTAT NO. 197

The styling and size of the Humidistat is the same as that of the Two-Eleven Thermostat. They may be used side by side as a matched set mounted on a plate especially designed for that purpose. The No. 197 is equipped with the extremely sensitive Friez element.

THESE CONTROLS ASSURE YOU *Air Conditioning* AT ITS BEST

An air conditioning system can be only as good as its Controls. Good Controls bring out the advantages of well engineered heating units, humidification apparatus, cooling and ventilating equipment. Without good Controls the best of equipment is seriously penalized. It is therefore just good business management for the installer to use reliable Controls in order to build good will and avoid unprofitable servicing. "Genuine Detroit" Controls are the best you can get. Their effectiveness and dependability have been proven by years of satisfactory operation. They perform consistently from the time they are installed and they permit every piece of equipment in the system to function at its best.

For full description write for bulletin on air conditioning, refrigeration and heating Controls.

"GENUINE DETROIT" SOLENOID NO. 683W2

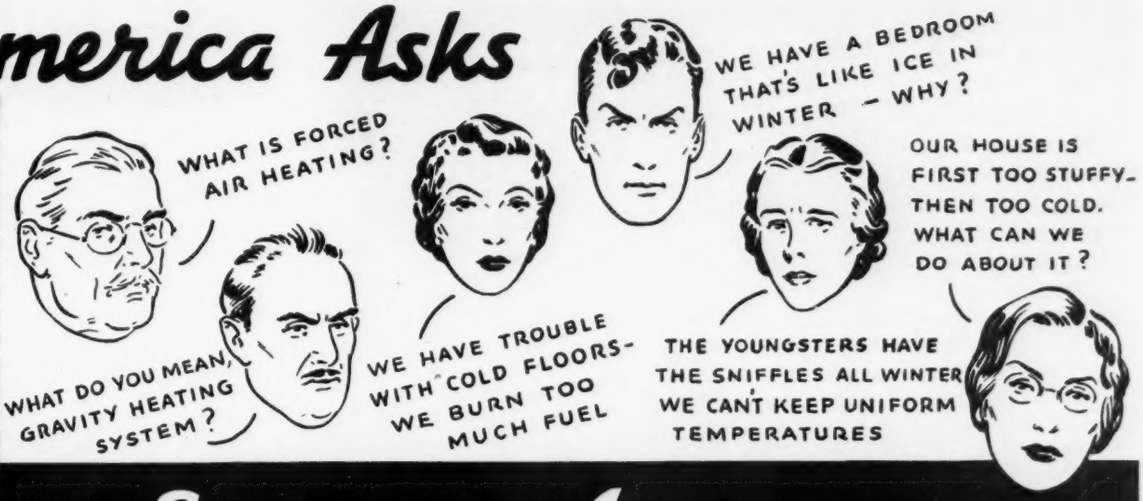
This Solenoid for the control of humidification water supply, is THE silent solenoid—no disagreeable A. C. hum can be telegraphed through the water pipe to living quarters above. A heavy kick-off spring and ingenious needle and seat construction eliminate any tendency to stick. The No. 683W2 readily opens against any city water pressure. Another model "Genuine Detroit" Solenoid is available for refrigeration lines.

SELF CLEANING SPRAY NOZZLE NO. 291

The No. 291 will save its cost to the installer usually in the first season by eliminating service cost. It automatically cleans out its orifice each time it functions. No scale or sediment is allowed to remain and therefore no chance for a clogged nozzle. Is used with either hot or cold water and may be installed in any position—ideally suited for installation in series without a special header.

DETROIT LUBRICATOR COMPANY DETROIT, MICH., U. S. A.
5900 Trumbull Avenue
NEW YORK, N. Y.—40 West 40th St. • CHICAGO, ILL.—816 S. Michigan Ave.
LOS ANGELES, CALIF.—320 Crocker St.
DIVISION OF AMERICAN RADIATOR & STANDARD SANITARY CORPORATION
Canadian Representative—RAILWAY AND ENGINEERING SPECIALTIES LIMITED, Montreal, Toronto, Winnipeg

America Asks


WHAT IS FORCED AIR HEATING?
WE HAVE A BEDROOM THAT'S LIKE ICE IN WINTER — WHY?
OUR HOUSE IS FIRST TOO STUFFY—THEN TOO COLD. WHAT CAN WE DO ABOUT IT?
WHAT DO YOU MEAN, GRAVITY HEATING SYSTEM?
WE HAVE TROUBLE WITH COLD FLOORS—WE BURN TOO MUCH FUEL
THE YOUNGSTERS HAVE THE SNIFFLES ALL WINTER WE CAN'T KEEP UNIFORM TEMPERATURES

..... Emerson Answers

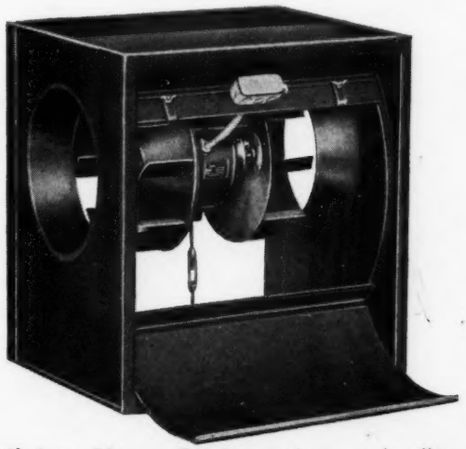
With COMPLETE NEW LINE of

PACKAGE UNIT FURNACE BLOWERS

and a Complete New Line of

SKELETON TYPE BLOWERS

Back-View of Emerson Package Unit Blower, showing its compactness.



Skeleton Blower.. For the manufacturer or installer who builds his own housings—the Emerson Skeleton Blower is recommended. Specially-engineered, multi-speed motor—on rubber-insulated spoke mounting—ready to fit right in with your own unit. Complete with 8-speed control unit.

EMERSON also answers the question of dealer profit with a new NET-PRICE buying plan! Now you can compete successfully with other package-unit blowers and at the same time offer a unit that is vastly superior in performance. Here's the proof—specially-designed, direct-drive, multi-speed, rubber-mounted motors—no belts to stretch or to adjust manually for various speeds—no vibration noises—only two places to lubricate—low-cost operation—no servicing expense. Eight speeds simplify balancing of the heating system to the exact requirements of the home.

Emerson Package-Unit Furnace Blowers are now attractively finished in red and black, complete with filters and 8-speed control unit—ready for prompt shipment. Here's a line that offers you exceptional sales advantages—mail the coupon below, now.

FREE Beautiful Package-Unit Blower Display Stand—A powerful Silent Salesman—with Order for One No. 17-E Emerson Blower Package Unit. Send Coupon for Details.

EMERSON ELECTRIC

MOTORS – FANS – APPLIANCES

20

AA-12

EMERSON ELECTRIC MFG. CO., St. Louis, Missouri.

Gentlemen: — I am interested in your new line of ☐ Emerson Package-Unit Blowers. ☐ Skeleton Type Blowers. Please send Catalog, Prices and Terms, and full details about Free Display Stand. No obligation.

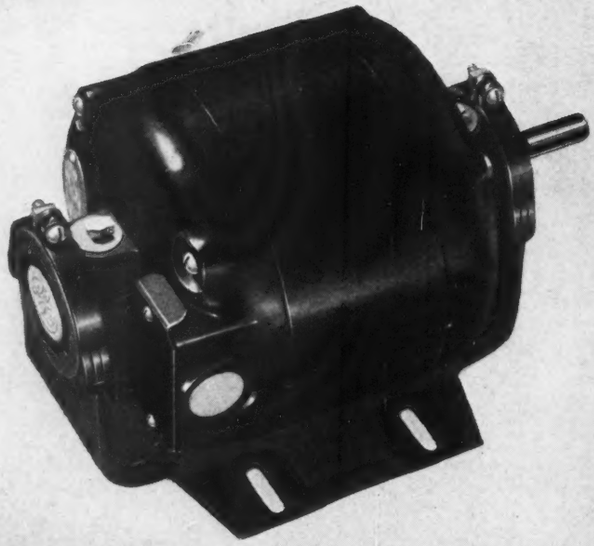
*Name*_____

*Address*_____

*City*_____ *State*_____

TWICE FORTUNATE
IS THIS HEATING CONTRACTOR

1. He handles a reputable make of equipment
2. This equipment is powered with G-E motors



LET G-E MOTORS HELP YOU SELL

YES, this dealer is doubly fortunate. He sells air-conditioning and warm-air equipment that is made by a manufacturer who has made good products for many years; and, in addition, this equipment is powered with G-E motors. The reputation of the manufacturer, plus the reputation of General Electric, leaves no doubt in the minds of prospects concerning the high quality of this heating equipment; thus the dealer can spend more of his time in convincing prospects of the advantages and economies of modern air-conditioning and warm-air equipment.

General Electric's high standards of quality are well known, and G-E motors have an enviable service record for quiet, dependable operation. If the heating apparatus you sell is equipped with G-E motors, you can make sales more easily because your customers will have added conviction that the products you sell will give them the trouble-free service they want.

Can you afford not to avail yourself of this added sales appeal?

General Electric, Dept. 6A-201, Schenectady, New York.

84 PER CENT SAID, "GENERAL ELECTRIC"

In a recent impartial survey, electric-appliance dealers and department stores were asked:

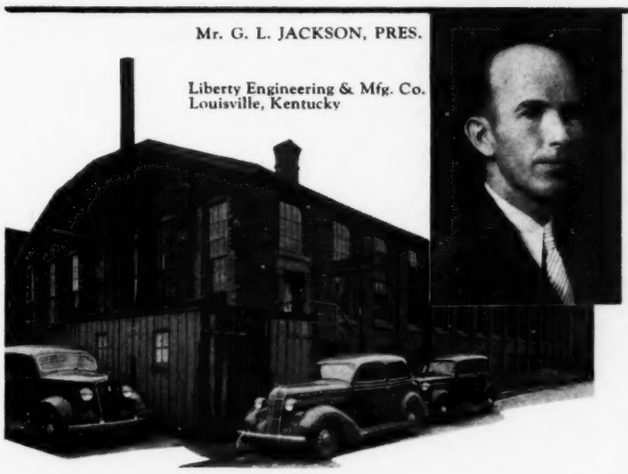
"What makes—or brands—of electric motors, in your opinion, would make it easier for you to sell appliances?"

General Electric was named by 84 per cent.

070-160

GENERAL ELECTRIC

BOOM YOUR BUSINESS AS THIS FIRM DID SELLING TRANE *Air Conditioning*



Mr. G. L. JACKSON, PRES.

Liberty Engineering & Mfg. Co.
Louisville, Kentucky

100% INCREASE

Here is a firm that has enjoyed the sweets of a business boom in the leanest depression years. A one hundred per cent increase each year for the past three! And with a smile, young President G. L. Jackson, head of Liberty Engineering & Manufacturing Company, Louisville, Kentucky, gives all the credit to air conditioning sales.

For five years, Mr. Jackson's organization has been busily selling Trane Air Conditioning. As they continue, their enthusiasm for the Trane line mounts. In Mr. Jackson's words, "The complete line of Trane Air Conditioners is of great assistance to us because it enables us to handle any application and give our customers the system that will best suit their needs."

The Liberty Engineering & Manufacturing Company has an impressive list of installations in Louisville. They find restaurants, stores, theatres and the like to be ready buyers. Since 1931, Liberty's progress has been phenomenal. But no more than that of many other aggressive firms in the air conditioning business.

The local Trane representative is a great help. He cheerfully offers his assistance whenever it is needed. He lends the advantages of his thorough knowledge of Trane equipment.

You can have customers who will testify their satisfaction as has Mr. Long in the letter below. Handling Trane proved air conditioning will open the road to profitable repeat business.

Trane Offers Sheet Metal Contractors An Opportunity To Become Established Air Conditioning Dealers.

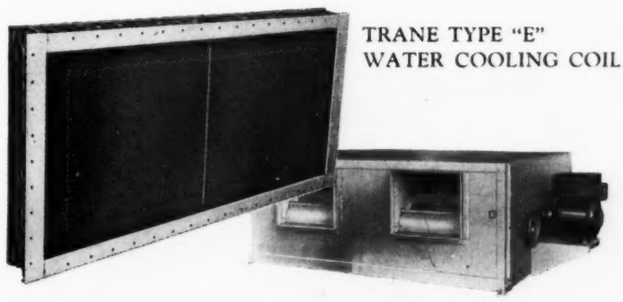
A new industry, brimming with success, offers you an opportunity to get in at the start. A chance to grow as it grows.

Your present equipment is sufficient. You spend no money. You know the distribution of heated air. The same simple principles apply to air conditioning. It will be easy for you.

There is a big nation-wide demand for air conditioning. Stores, restaurants, theatres, hotels and many more know how air conditioning will stimulate their business. With natural foresight, canny builders specify it. They are all potential customers of yours.

There is an army of skilled Trane engineers located at various points all over the country. It is their duty to help you select and to advise you concerning the installation of Trane air conditioning equipment. There is one in your territory ready to answer your call.

If you are interested in booming your business; if you want to enjoy plenty of profits during the spring and summer; write for the free portfolio that tells how you can get in on this new field—how Trane will help you get started.



TRANE TYPE "E"
WATER COOLING COIL

TRANE CLIMATE CHANGER

YOU CAN HAVE SATISFIED CUSTOMERS LIKE MR. LONG

FOURTH AVENUE AMUSEMENT CO.
Suite 350 Francis Building
Louisville, Ky.

October 9th, 1936

Liberty Engineering & Mfg. Company
355 Holland Street
Louisville, Kentucky

Gentlemen:

We wish to advise you that during the last few years we have installed both sprays and water cooling coils in several of our different theatres. We find we obtain more efficiency and more comfort by using the coils instead of sprays.

One of our most efficient and satisfactory installations is in our Strand Theatre, Louisville which was installed by you. Here we are using three banks of Trane Coils and well water exclusively, pumping 320 gallons per minute. It is not necessary to recirculate any of the air as the cost of cooling is so small and we always give our patrons that wonderful feeling of freshness.

Several years ago we were the first ones, that I know of, to cool a theatre exclusively with well water which was passed through coils. We installed this system in the Rialto Theatre, Louisville and used Trane Coils exclusively. These are still in use and giving very satisfactory service at a very low operating cost. There is practically no maintenance cost in this type of system.

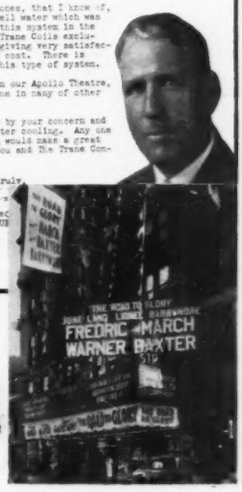
We have also installed Trane Coils in our Apollo Theatre, Indianapolis and intend to do the same in many of other theatres.

Most of the above work has been done by your concern and we regard you as pioneers in well water cooling. Any one wishing to make such an installation would make a great mistake if they did not first take you and The Trane Company into consideration.

Yours very truly,

D.H.Long, Sec
FOURTH AVENUE

DHL:MB



Write

THE TRANE COMPANY

TRANE *about handling year round air-conditioning* TRANE

LA CROSSE - - - - - - - - WISCONSIN

In Canada—Mowat & King Sts. W.—Toronto

DUSTOP
AIR FILTERS
FIBERGLAS MEDIUM · ADHESIVE COATED · REPLACEMENT TYPE

The program of the National Warm Air Heating & Air Conditioning Association Convention definitely indicates that 1937 will be a Merchandising Year! DUST-STOP will continue its support of the Association's program of merchandising the comfort, convenience and economy of CLEAN, WARM AIR.

1937 is going to be a year of intensive MERCHANDISING in the Warm Air Heating and Air Conditioning industry. . . Owens-Illinois has laid its plans for a broad and constructive program which will help you merchandise and sell more original installations and establish a profitable replacement-service market.

OWENS-ILLINOIS GLASS COMPANY • • • 301 MADISON AVE., TOLEDO, OHIO.

Michigan State College Sixth Short Course in Warm Air Heating

MARCH 29th to April 1st, 1937 is announced as the date for the 6th annual Michigan State College Warm Air Short Course.

The committee in charge has promised a most interesting and enjoyable meeting and several new features which will improve the course.

The most important announcement of the committee is that the new technical code for the design and installation of forced warm air systems, as drawn up by the code committee of the National Warm Air Heating and Air Conditioning Association, will be the text used for this Course.

Another important announcement is that instead of the lecture course method previously used, the entire assembly will be divided into small groups, each man selecting his course as he desires. In this manner the students will come in closer contact with the instructors and with each other.

Third, there will be three definite courses. First, the elementary course for those desiring only the first essentials of engineering. The course will deal only with the simple necessities of engineering.

The advanced course will take up the new code from beginning to end, including correcting the CFM to compensate for temperature drop in ducts, and correcting branch and stack sizes to compensate for the varying resistances in pipes due to unequal equivalent lengths.

There will be a third course in elementary cooling, which will deal in the various types of cooling, such as attic ventilation, well water or ice water cooling, and refrigerant cooling. This course will also cover figuring the cooling load both for latent heat and sensible heat of small residences and small commercial buildings such as restaurants, tea rooms, etc.

This year all students will be housed in a new dormitory built for students of various short courses given by the college. It is also planned that all in attendance will eat together. This will give the students exceptional opportunity in acquainting themselves with others vitally interested in the industry.

The cost of this course will be about $13.00 to $14.00. This will include board, room and tuition. The cost of this course has been held down to enable all interested to attend without too much expense.

The following is an outline of the three courses:

Elementary Course

1. Heat Loss
   - a. What is a BTU?
   - b. Conductivity and table of same.
   - c. Exposure losses.
   - d. Figuring heat losses.
   - e. Infiltration.
2. C.F.M.
   - a. Selecting total CFM.
   - b. CFM factor and register temperatures.
   - c. CFM for each room.
3. Designing System
   - a. Preliminary sketch.
   - b. Selecting static pressure.
   - c. Sizing stacks.
   - d. Sizing branches.
   - e. Sizing ducts.
4. Registers
   - a. Location.
   - b. Types of registers.
   - c. Sizing registers.
5. Sizing Equipment
   - a. Furnace.
   - b. Blowers.
   - c. Filters or other appurtenances.
6. Controls
   - a. Coal.
   - b. Oil.
   - c. Gas.
7. Construction
   - a. Stacks.
   - b. Ducts.
8. Simple Problems
   - a. Heat loss.
   - b. CFM required.
   - c. Layout of system.
   - d. Selection of equipment.
9. Test Covering Entire Elementary Course.

Advanced Course

1. Review Heat Losses
   - a. Conductivity.
   - b. Resistivity.
   - c. Computing Conductance.
   - e. Infiltration.
2. C.F.M.
   - a. Selecting total CFM.
   - b. Average register temperature.
   - c. Uncorrected CFM per room.
   - d. Temperature drop in ducts.
   - e. True register temperature.
   - f. Correcting CFM to compensate for temp. drop in ducts.
3. Designing System
   - a. Preliminary sketch.
   - b. Selecting static pressure.
   - c. Sizing stacks, branches and ducts.
   - d. Correcting for difference in equivalent lengths from register to bonnet of heater.
4. Registers
   - a. Location.
   - b. Types.
   - c. Sizing.
5. Sizing Equipment
   - a. Furnace.
   - b. Blowers.
   - c. Filters or other appurtenances.
6. Controls
   - a. Coal.
   - b. Oil.
   - c. Gas.
   - d. Zone controls.
7. Construction
   - a. Stacks.
   - b. Ducts.
   - c. Various types of dampers.
8. Simple Problems
   - a. Complete heat loss and design entire systems.
9. Test Covering Course.

Elementary Cooling

1. Attic Cooling
   - a. Various heights of same.
2. Water Cooling
   - a. Well water.
   - b. Ice water.
3. Refrigerant Cooling
4. Figuring Cooling Load
   - a. Latent heat load.
   - b. Sensible heat load.
5. Selecting Equipment
   - a. Coils.
   - b. Pumps or compressors.
6. Layout of Distribution System.
7. Simple Problems.
8. Examination.

Factors Affecting Fuel Saving*

By S. Konzo
Special Research Associate
Engineering Experiment Station
University of Illinois

Fuel Saving by Changes in House Construction

Introduction

THE amount of fuel required to heat a given structure is dependent on the nature of the construction of the building, the type of heating installation, and the method of operation of the heating plant. Improvements in building construction and modifications in the operation of the heating plant will affect to a greater or lesser extent the amount of fuel required. It is the purpose of this paper to discuss some of the improvements and modifications possible in the ordinary heating system, and to present approximate percentages of fuel savings that can be effected with each change. In addition to the results obtained in connection with the tests conducted in the Warm Air Research Residence, results from other investigations have been used.

If a structure is to be maintained at a temperature greater than that of the air outdoors, sufficient heat must be supplied to the structure to offset the heat loss from it to the outdoors. It is evident that for a given outdoor condition any change in the structure which will change the amount of this heat loss will affect the amount of heat to be supplied to the structure, which in turn will affect the amount of fuel required to produce this heat. In fact, the most effective means of making substantial reductions in fuel consumption consist in improvements in the house construction in the form of weatherstripping, insulation, and storm sash.

(a) Storm Windows and Doors

It is obvious that the percentage of reduction in fuel consumption with and without the use of storm doors and windows is dependent on the nature of the wall construction and the ratio of exposed window surface to net wall surface. For a given room or house, storm windows and doors will effect a larger percentage saving when the wall is well heat-insulated than when it is not. Also, for two rooms of the same size having the same wall construction, but different ratios of window surface to net wall surface, the percentage of fuel saving will be greater when storm windows are applied to the room which has the larger ratio of exposed window surface to net wall surface, than it will be when the storm windows are applied to the room having the smaller ratio.

With due recognition of the fact that the fuel savings resulting from the use of storm windows and doors in any given installation may not be generally applicable to all installations, nevertheless it is of interest to note the results obtained from tests* conducted in the Research Residence.

Test House and Equipment

The Residence is a three-story structure of standard frame construction. The wall section consists of weather boarding, building paper, sheathing, six-inch studding, wood lath, and plaster with rough sand finish. The walls are not insulated, and no weatherstripping is used at the windows and doors. The total space heated during these tests consisted of three rooms, a sun parlor, a breakfast nook, and a hall-way on the first story; three rooms, a bath room, and a hall-way on the second story; and two rooms, a bath room, and a hall-way on the third story. The total volume of this heated space, from which the basement was excluded, was approximately 17,540 cubic feet. The calculated heat loss was approximately 137,500 Btu per hr. at an indoor-outdoor temperature difference of 70 deg. F.

The heating plant consisted of a coal-fired furnace used in connection with a forced-air heating system. The control of the heating plant was accomplished by means of a room thermostat operating to open and close the ash pit damper and to start and stop the fan. The room thermostat was located on an inside wall of the dining room at a height of 5 ft. from the floor, and was adjusted to maintain an air temperature of approximately 71 deg. F. at this level in all of the rooms of the Residence.

One series of tests was run with the Residence equipped with storm windows and door, and one series was run without such equipment. For the first-mentioned series all of the windows on the three stories of the Residence, with the exception of two small quarter-round windows in the east dormitory, were provided

*Paper presented at the First Annual Conference on Air Conditioning, held at University of Illinois, May 4 and 5, 1936.

*A complete discussion on tests in the Research Residence is found in the paper entitled "Fuel Savings Resulting from the Use of Storm Windows and Doors" by A. P. Kratz and S. Konzo, A.S.H. and V.E. Journal, Section of Heating, Piping and Air Conditioning, December, 1935.

with tightly-fitting storm sash. As shown in Fig. 1, felt stripping was placed along all four contact edges and the storm sash was clamped tightly to the window casing by means of screws. The areas of window and door openings, and of wall surfaces, and the ratios of openings to wall surfaces are given in Table I.

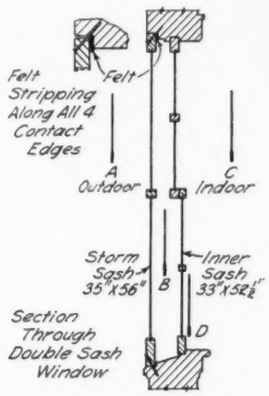


Fig. 1—Method of Installing Storm Sash

Data on the amount of fuel required to operate the Research Residence with and without storm windows and doors are presented in Fig. 2, in which the daily fuel consumption, in pounds of coal, is plotted against the difference in temperature between indoors and outdoors.

The curves show that the average daily amount of fuel required to heat the residence when the outdoor temperature was 40 deg. F., which corresponds closely to the mean seasonal temperature in Urbana, Illinois, was 100 lb. when storm doors and windows were not used, and 81 lb. when storm doors and windows were used. This represents a saving in fuel consumption of 19 per cent attributable to storm windows and doors. The saving in milder weather was somewhat less, but in severer weather increased up to a value of 21 per cent for zero weather, or at an indoor-outdoor temperature difference of 70 deg. F. The results, therefore, indicate that a saving of approximately 20 per cent in the seasonal fuel consumption could be reasonably attributed to the installation of storm doors and windows on the Research Residence.

TABLE 1

DATA ON WINDOW AND WALL SURFACES

1	Number of window openings	50
2	Number of windows equipped with storm sash	48
3	Number of door openings to outdoors	2
4	Number of storm doors	1
5	Area of exposed window openings, sq. ft.	525
6	Area of windows equipped with storm sash, sq. ft.	522
7	Area of exposed door, sq. ft.	24.5
8	Area of double door, sq. ft.	24.5
9	Gross area of exposed structure, sq. ft.	3004.5
10	Net area of exposed wall (windows and doors excluded), sq. ft.	2455
11	Ratio of storm windows and doors to total exposed openings, per cent	99.4
12	Ratio of total exposed openings to gross wall, per cent	17.5
13	Ratio of total exposed openings to net wall, per cent	21.4

The calculated reduction in heat losses was obtained by computing the heat losses from the structure both with and without storm windows and doors. The difference between the two calculated values would be accounted for in the items involving infiltration and heat transmission through windows and doors. These items were therefore calculated for a zero day, or for an indoor-outdoor temperature difference of 70 deg. F., and added to the basic heat loss of 73,770 Btu per hr. which took place through walls, ceilings, floors, and all parts of the structure exclusive of the exposed windows and the front door. The data used for the calculation of the infiltration and heat transmission losses through the windows and door are given in Table 2, for which the coefficients were obtained from the American Society of Heating and Ventilating Engineers Guide for 1936.

TABLE 2

CALCULATED HEAT LOSS DATA, BASED ON 70 DEG. F. TEMPERATURE DIFFERENCE

No.	Item	Without Storm Sash	With Storm Sash	With Weather Stripping
1	Heat loss through walls, floors, and ceilings, Btu per hr.	73,770	73,770	73,770
2	Lineal feet of crack around windows (one-half of total)	356	356	356
3	Lineal feet of crack around door	21	21	21
4	Total area of windows, sq. ft.	525	525	525
5	Area of windows with storm sash, sq. ft. (with weather striping)	.....	522	522
6	Area of windows without storm sash (without weather stripping)	525	3	3
7	Area of door, sq. ft.	24.5	24.5	24.5
8	Infiltration coefficient for windows, Btu per lineal ft. of crack per deg. F. per hr.	0.74*	0.34*	0.43†
9	Infiltration coefficient for door, Btu per lineal ft. of crack per deg. F. per hr.	2.00	1.00	1.00
10	Coefficient of heat transmission for windows, Btu per sq. ft. per deg. F. per hr.	1.13	0.45	1.13
11	Coefficient of heat transmission for door, Btu per sq. ft. per deg. F. per hr.	0.52	0.52	0.52
12	Calculated heat loss through doors and windows, Btu per hr.	63,800	27,070	54,606
13	Total calculated heat loss from building, Btu per hr.	137,570	100,840	128,376
14	Calculated saving, per cent	.....	26.7	6.7
15	Actual saving from tests, per cent	.....	21.0	.....

*Based on a well fitted window having $\frac{1}{64}$-in. crack and $\frac{1}{32}$-in. clearance.

†Based on infiltration of 23.6 cu. ft. per lineal ft. of crack. See A.S.H. and V. E. Guide of 1936, p. 135, Table 2, under column for 15 mile per hour wind velocity.

From Table 2 it may be observed that the calculated heat loss was 137,570 Btu per hr. for the building not equipped with storm windows and door, and 100,840 Btu per hr. for the building equipped with storm windows and door. This represented a computed saving of 26.7 per cent as compared with the actual saving of 21

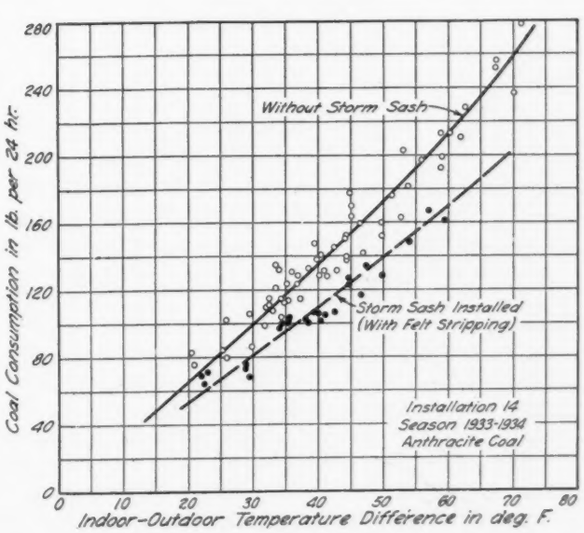


Fig. 2—Fuel Consumption With and Without Storm Sash

TABLE 3

CALCULATED HEAT LOSSES FOR TYPICAL RESIDENCE

Cases	Calculated Heat Loss Through Various Parts of House, in Btu per hour: Roof	Walls	Glass	Infiltration	Door	Floor	Total	Reduction in Heat Loss Per Cent
(a) No insulation or storm sash*	16,200	27,000	25,800	24,600	4,300	2,100	100,000	0
(b) 1-in. insulation in sidewall†	16,200	14,200	25,800	24,600	4,300	2,100	87,200	12.8
(c) 2-in. insulation in sidewall	16,200	9,590	25,800	24,600	4,300	2,100	82,590	17.4
(d) 3-in. insulation in sidewall	16,200	7,290	25,800	24,600	4,300	2,100	80,290	19.7
(e) 3⅝-in. insulation in sidewall	16,200	6,620	25,800	24,600	4,300	2,100	79,640	20.3
(f) 1-in. insulation in ceiling‡	4,910	27,000	25,800	24,600	4,300	2,100	88,710	11.3
(g) 2-in. insulation in ceiling	2,900	27,000	25,800	24,600	4,300	2,100	86,700	13.3
(h) 3-in. insulation in ceiling	2,060	27,000	25,800	24,600	4,300	2,100	85,860	14.1
(i) 3⅝-in. insulation in ceiling	1,720	27,000	25,800	24,600	4,300	2,100	85,520	14.5
(j) 3⅝-in. insulation in walls and ceiling	1,720	6,620	25,800	24,600	4,300	2,100	65,140	34.8
(k) Weather stripping on all windows¶	16,200	27,000	25,800	14,760	4,300	2,100	90,160	9.8
(l) Storm windows and doors all over§	16,200	27,000	10,270	11,320	1,840	2,100	68,730	31.3
(m) 3⅝-in. insulation in walls and ceiling and storm windows and door	1,720	6,620	10,270	11,320	1,840	2,100	33,870	66.1

*Values from discussion by C. G. Segeler in A.S.H. and V.E. Transactions of 1928, Vol. 34, p. 473; average values from 200 homes.
†Original wall assumed to be of ordinary frame construction consisting of yellow pine lap siding, building paper, 1-in. fir sheathing, 3⅝-in. studding space, wood lath and plaster, over-all coefficient = 0.245. With addition of wool insulation having conductivity of 0.27 Btu per inch, the overall coefficient of heat transmission becomes: 0.129 Btu for 1 in. insulation, 0.087 for 2 in., 0.066 for 3 in., and 0.060 for 3⅝ in.
‡Original ceiling assumed to consist of wood lath and plaster, unfloored, over-all coefficient of 0.62. With addition of wool insulation having conductivity of 0.27 Btu per inch, the over-all coefficient of heat transmission becomes: 0.188 Btu for 1 in. insulation, 0.111 Btu for 2 in. 0.079 Btu for 3 in., and 0.066 Btu for 3⅝ in. fill.
¶Leakage without weatherstripping = 39.3 cu. ft. per ft. of crack, with weatherstripping = 23.6 cu. ft. per ft. of crack.
§Over-all coefficient single window = 1.13 Btu, double window = 0.45 Btu. Infiltration values, single window = 0.74 Btu, storm windows = 0.34 Btu.

per cent shown at an indoor-outdoor temperature difference of 70 deg. F. by the test curves in Fig. 2. This may be regarded as fairly close agreement, considering the uncertainties which necessarily accompany the computation of infiltration losses. It is possible that all fuel savings based on calculated values of maximum heat transmission may tend to be higher than the actual fuel savings obtained under average weather conditions. The calculated values in Sections (b) and (c) to follow should, therefore, be regarded as maximum theoretical savings.

Other Advantages of Storm Sash

In addition to fuel saving, other advantages incident to the operation with storm sash became evident. The tightly-fitting storm sash practically eliminated the entrance of soot, which in the case of the unprotected windows sifted in and collected in sufficient quantity on the white window stools to make daily cleaning necessary. The use of storm windows also enabled the maintenance of higher indoor relative humidities without condensation on the windows. They were also effective in reducing the downward draft of cold air usually present with unprotected windows. The immediate effect of this reduction in draft was an increase in the air temperature in the living zone of the room, particularly near the floor. This increase in the air temperature in the living zone, together with the increase in the surface temperature of the glass surfaces exposed to the occupant, resulted in an increase in the comfort conditions in the room when the same indoor temperature was maintained at the breathing level. Also, with a fixed setting of the controlling thermostat there was a marked reduction in the total time of fan operation in the forced-air system, accompanying a reduction in fuel consumption, when the storm windows were installed.

The advantages cited as resulting from the use of storm windows emphasize the importance of making adequate provision to reduce the heat losses at what may be regarded as the most vulnerable part of the structure from the standpoint of the heating installation, namely, the doors and windows. The problem of heating a room becomes greatly simplified when the ordinary unprotected windows are replaced by windows adequately protected by either weatherstripping, double-glass, or tightly fitted storm sash, although weatherstripping or double-glass alone are not as effective as tightly fitting storm windows.

(b) Calculated Savings Due to Weatherstripping

From Table 2, columns 1 and 3, it may be observed that the calculated heat loss was 137,570 Btu per hr. for the building not equipped with storm windows or weatherstripping, and 128,376 Btu per hr. for the building equipped with weatherstripping on all windows and the exposed door. This represents a computed saving of 6.7 per cent. These items were calculated for a zero day, and for a wind velocity of 15 miles per hour. For average weather conditions in Urbana with wind velocities much less than 15 miles per hr. the fuel savings will probably be less than the percentages stated. If the same degree of correlation were obtained between the calculated saving and actual saving as was obtained in the case of the storm windows, the probable fuel saving with all the windows equipped with weatherstripping would be of the order of 5.3 per cent.

In addition to this saving in the cost of fuel, weatherstripping should also add very largely to the comfort of the occupants by reducing drafts created by excessive air leakage.

It is obvious, as in the case of storm windows, that the percentage of reduction in fuel consumption with and without the use of weatherstripping is dependent on the nature of the wall construction, the tightness of the windows, and the amount of linear feet of crackage around the windows and doors in the house. Furthermore, for a given room or house, the calculated percentage of fuel saving will be larger when weatherstripping is applied to loosely-fitting windows than when it is applied to tightly-fitting windows and doors.

(c) Calculated Savings with Insulation

Certain details of construction in the Research Residence, where the space directly under the roof has been utilized for dormitory space, make it rather difficult to calculate the possible fuel savings with the use of insulation. It is more convenient for the present purpose

(*Continued on page 60*)

Rigid Insulation [Part 2]

By Paul D. Close

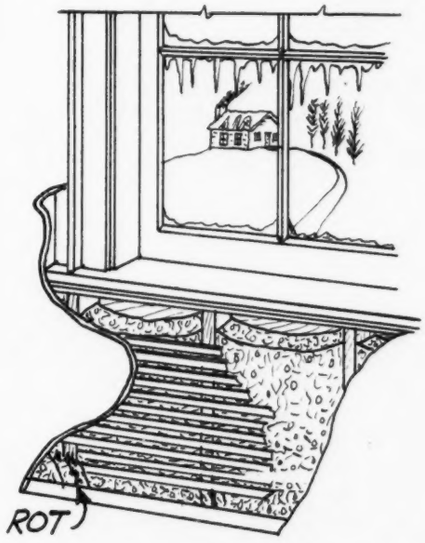
In Part I (November) the author explained the purposes of insulation, the law of diminishing return, economics of insulation, costs, etc. This article discusses moisture problems, cracks, bracing and attenuation.

Attenuation of Ceiling Insulation

IT IS obvious that materials of this character will not settle to any appreciable extent when installed between horizontal ceiling joists. However, if the material is spread too thin, the insulation may lose a large portion of its value due to convection through the large voids.

Moisture Condensation

A controversial objection to fill insulation is condensation of moisture within the voids or interstices. This is known as interstitial condensation. If materials of this character are installed between the studding during seasons when conditions are humid, the air spaces or voids will contain a percentage of moisture which remains entrapped when the wall is sealed. This moisture will condense within the insulation to a liquid during the cold winter months just as water vapor condenses on cold surfaces such as windows. This water not only destroys a large part of the insulating value of the fill, but if present in large quantities tends to rot out the framing members and damage the plaster.

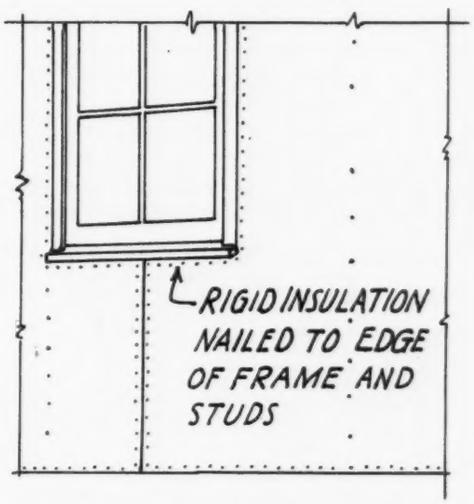


If moisture collects in the interstices of insulation it eventually works to the bottom of the space causing rot.

Moisture troubles with all insulations have been particularly common in humidified residences. Plastered walls tend to breathe so that the moisture in humidified buildings may find its way into the insulation between the studding and will condense to a liquid at the dew-point temperature which may exist within the fill insulation during cold weather. Bathrooms and kitchens also are a common source of moisture generation in residences.

Studding, Headers, Etc.

An important point frequently overlooked is the fact that fill types of insulation are installed between framing members and consequently the full value of the insulation is not obtained. Such framing members comprise 10 per cent or more of the net wall area, but listed heat transfer coefficients do not take this fact into consideration. With the usual rigid types of insulation, the insulation is continuous and unbroken as it covers the framing members.



Large sheets of rigid insulation make fewer cracks and provide some amount of bracing effect.

A point frequently overlooked is the fact that rigid insulation gives fewer cracks and joints, thereby minimizing losses due to infiltration, which are not ordinarily accounted for in heat loss calculations, fuel savings and return on the investment.

Tests and experience show that a wall sheathed with rigid insulation is stronger than the ordinary horizontally lumber sheathed wall if the insulation is properly applied, is of a grade which possesses internal strength and is properly sealed against moisture because the rigid insulation sheathing provides bracing

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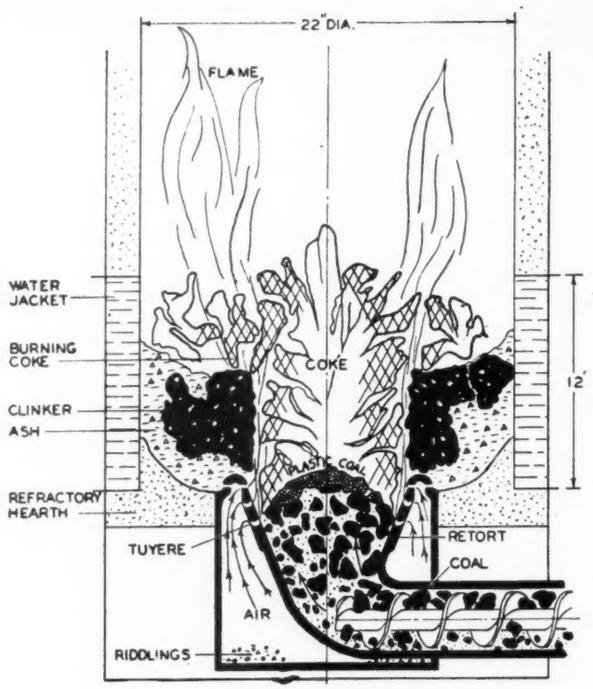

Fig. 2—Cross section of retort and fuel bed with weakly caking coal.

Intermittent operation. Coal size 1¼ in. to 0. Btu per hour heat release, 187,500; 58 per cent excess air; feed rate, 36 lb. per hour.

The Combustion of Bituminous Coal in a Small Underfeed Stoker§

By

Ralph A. Sherman* and E. R. Kaiser†

THE remarkable increase in the distribution of the small underfeed stoker for use in furnaces and boilers in small industrial plants, apartment houses and homes has brought producers and distributors of bituminous coal to consider the problem of which coals and which sizes are best suited to this market. Many papers have also appeared, mostly in the trade journals, discussing the problem of the combustion of various coals and various sizes of coal in small stokers. Much difference of opinion has been apparent in these articles; due often, it would appear, to a misunderstanding of the fundamentals of the process of combustion in the stoker fuel bed.

During the past year and a half, a program of research has been conducted at Battelle Memorial Institute, Columbus, Ohio: (1) On the process of combustion in the fuel bed of the small stoker, sponsored by Battelle Memorial Institute, and (2) on the relation of the characteristics of bituminous coals to their performance on small underfeed stokers, sponsored by Bituminous Coal Research, Inc. As a result of this program of research, two publications have been made, one[1] dealing with the problem of clinker formation, and the other[2] with the relation of the size of the coal fed to the stoker hopper to that of the coal that reaches the retort to be burned. The experimental research on the relation of size to the performance of the coal is being actively continued. A publication of Bituminous Coal Research, Inc., presenting the data obtained on the performance of several sizes of four typical bituminous coals will appear shortly.

§Reprinted from a pamphlet by the same name published by the American Institute of Mining and Metallurgical Engineers, New York.
*Fuel Engineer, Battelle Memorial Institute, Columbus, Ohio.
†Assistant Fuel Engineer, Battelle Memorial Institute.

1. R. A. Sherman and E. R. Kaiser: Clinker Formation in Small Underfeed Stokers. *Inf. Bull.* No. 1, Bituminous Coal Research, Inc. (Jan. 1936).
2. R. A. Sherman and E. R. Kaiser: The Relation of the Size of Bituminous Coals to their Performance on Small Underfeed Stokers—The Relation of the Size of the Hopper to that Burned in the Retort. *Tech. Rept.* No. 1, Bituminous Coal Research, Inc. (Dec., 1935) pt. 1.

Because of the early appearance of that publication, the present paper includes few numerical data. The purpose of this paper is to follow the coal from the hopper through the furnace with a discussion of the various actions that occur, in the hope that it will lead to a clearer understanding of the relation of the type of coal, the size of coal, and other characteristics, to the performance. The authors do not pretend to have obtained the answers to all the complex questions involved; many unanswered questions will be proposed on which future research work is planned.

Apparatus and Procedure

The stokers used in the tests are of typical residential size, with a nominal maximum rate of feeding of 30 to 35 lb. of coal per hour, installed in special test furnaces. The lower section immediately above the hearth is water-cooled and the upper part has a refractory lining. A door is provided for observation of the fuel bed and removal of the clinker. In the flue-gas outlet, samples of the gas may be taken for analysis and the temperature may be measured, and a smoke recorder is provided, based on the principle of the variation in the output of a photoelectric cell caused by the absorption of light by the smoke. The entire assembly is mounted on scales so that the rate of burning may be known at any time. The air supplied to the stoker is measured by means of the pressure drop across an orifice in the duct leading from a central fan. The duct connects to the stoker fan through a water seal, and, by the maintenance of atmospheric pressure at the inlet of the fan, the stoker fan operates as though it were not connected to the duct.

So far, the tests have consisted of preliminary periods of 24 hours of "hold-fire" operation, during which the stoker operates a few minutes every half hour or hour, followed by two to three periods of 8 hours each at varying air-coal ratios with an over-all rate of heat release of 187,500 Btu per hour. The stoker is set to feed and burn coal at approximately twice that rate; it is started three times per hour and stopped when the weight of combustible equivalent to one-third the required heat release has been lost from the furnace. This type of action simulates a more or less ideal type of heating plant and the time of operation and the uniformity of the time are measures of the performance of the coal.

During the tests no manual attention other than the charging of coal to the hopper and removal of clinker is given to the fire. During each test and at the close, frequent observations are made of the fuel bed, and sketches are drawn to show the position of ash, clinkers, coke, green coal and flames.

Functions of a Stoker

Although no heat-absorbing surfaces are provided, enough data are obtained in the tests so that a heat balance can be drawn up to show the possible efficiency of a boiler or furnace with the particular stoker and coal if certain flue-gas temperatures are assumed. Thus the functions of heat liberation and of heat absorption are separated.

The functions of a stoker are to feed coal from the bin or from the hopper into the combustion space, to supply air to the coal, to maintain a fire in the firebox at all times, to liberate heat from the coal in response to the demands of the thermostat in the living quarters or of the pressure or temperature-control device on the boiler, and, in the most common types of stokers, to convert the ash of the coal into a clinker that may be conveniently removed from the furnace at certain intervals. As previously stated, the stoker should perform these functions without manual attention other than the charging of the coal and the removal of the clinker. It should operate with little discharge of smoke from the chimney and almost without noise.

Obviously, it is also desirable that the stoker should burn the coal efficiently, which means that combustion should be complete within the combustion space with as little excess air as possible, that a minimum of fly carbon should be discharged from the combustion space, and that the clinkers should contain the minimum of unburned carbon.

Small underfeed stokers may differ in the degree with which they will fulfill these functions with any given coal, either because of their relative merits as machines, because of the correctness of the method of installation, or because of certain principles or refinements. The fundamental principles of the majority of stokers are, however, practically the same and this paper, as this research program, is concerned not with the effect of differences in stokers on the performance of the functions just enumerated, but with the mechanism of the series of events that begin at the stoker hopper and conclude with the complete combustion of the coal. The knowledge of the mechanism of these events will enable one to proceed with the selection of the proper coals and their preparations in the proper sizes for the most satisfactory performance of the stoker.

Flow of Coal from Hopper to Retort

The coal is fed, in these small stokers, from the hopper or bin into the retort by means of a feed screw. During this travel the coal is generally degraded in size to some extent, and in the hopper, in the feed tube and in the retort the various sizes tend to segregate even if an entirely uniform mixture of coal has been placed in the hopper. The fines tend to trickle through the coarse coal and be fed from the hopper first; they drop to the bottom of the feed tube and are pushed up toward the rear of the retort, usually at an angle to the axis of the screw on one side or the other, depending on the direction of rotation of the screw. *Technical Report* No. 1 of Bituminous Coal Research, Inc., has reported fully the result of an investigation of the segregation and crushing that occurs with different sizes of coal of different degrees of friability. Gebhardt[3] has presented further confirming data.

These investigations have shown that the segregation is decreased by bringing more closely together the limits of the sizes of coal fed to the stoker, preferably by a decrease in the top size, for the use of large sizes will result in crushing and the producion of smaller sizes.

The segregation of coal sizes is generally accompanied by a greater rate of feed to the rear than to the front

3. B. R. Gebhardt: Selling the Correct Size of Coal. *Coal-Heat* (1936) 29, 46-49.

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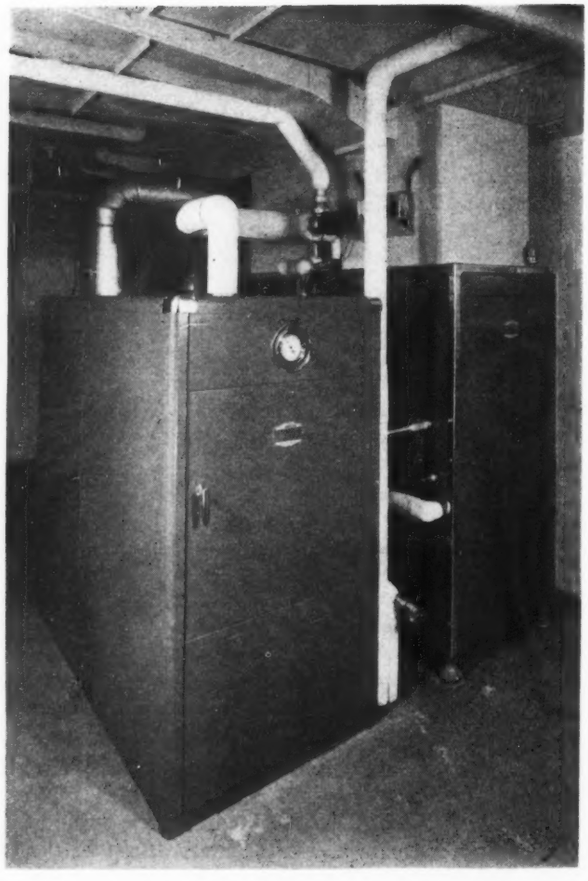


Year 'Round Air Conditioning with An Indirect System

THE owner of a large residence in Milwaukee had a gas-fired, forced air, heating system which heated, circulated, cleaned the air during the winter, but was more costly in fuel expense than desired and did not afford any summer cooling; nor was the system as modern in operation or as flexible as the owner wished.

The type of system which the owner desired would heat, clean, circulate, humidify in winter and cool, dehumidify, clean and circulate in summer and would be so arranged that through zoned distribution and control the weight of the heating or cooling functions could be concentrated in one of two zones of the residence. Automatic firing was demanded, but at a lower cost per heating season.

Plans to meet the owner's specifications were prepared by the Syncromatic Air Conditioning Corporation of Milwaukee with a resulting system which contains several features of interest.

Some Design Data

As shown by the exterior photograph the residence has conventional lines behind a stone outer wall, faces south and contains approximately 44,300 cubic feet. Based upon a 10 to 70 degree temperature rise the heat loss of the house is about 237,280 B.t.u. per hour. For summer cooling using a heat gain of—

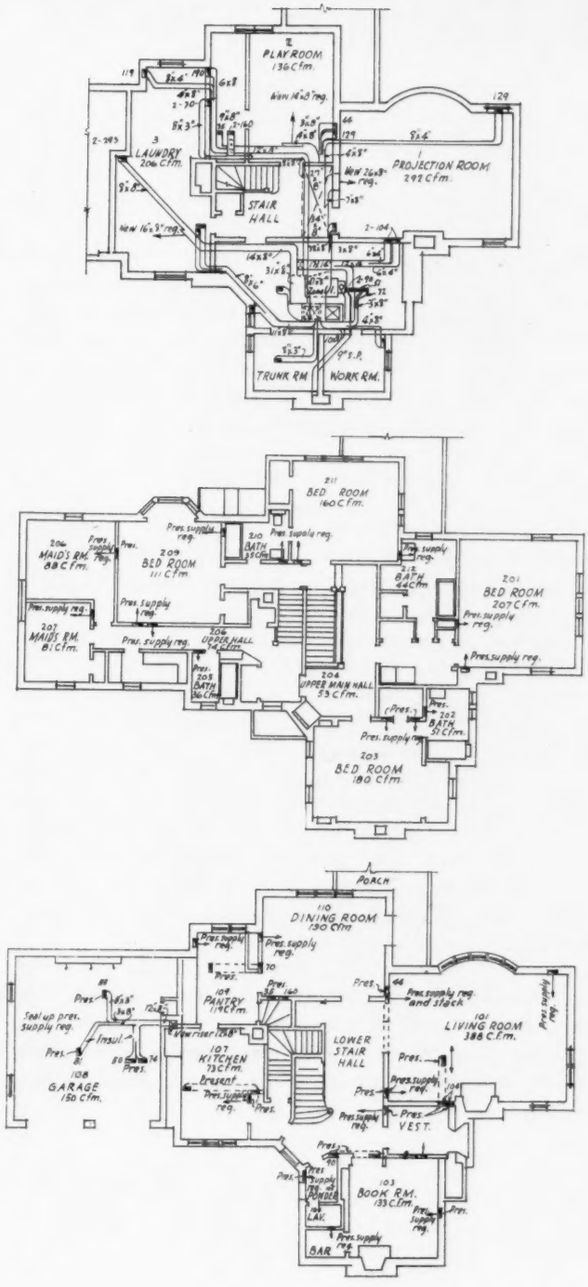
East exposure—30 degrees
West exposure—45 degrees
South exposure—40 degrees
North exposure—15 degrees

the heat gain is about 64,500 B.t.u.

Above is the oil burning boiler and air conditioning unit with shallow ducts, high plenum chamber and zone damper motors. Below is the exterior, indicating the size of the house.

◆

The apparatus used in the house consists of an oil-fired steel boiler supplying steam to an air conditioner which contains the blower and motor, heating and cooling coils, filters and a spray type humidifier. The unit has an output of 290,000 B.t.u. with 2 pounds steam pressure. The cooling capacity of the unit is 120,000 B.t.u. based upon a rating for a 40-degree evaporator. The blower operating at 650 r.p.m. will circulate 3,200 c.f.m. with a ½-horsepower motor. The spray type humidifier will evaporate 2½ gallons of water per hour if needed. The heating and cooling coil has a face area of 4.6 square feet and are 3-pass units.



The basement plan shows runs of ducts and pipe zoning, location of apparatus in basement and duct sizes. The second floor plan shows location of registers and returns and new and old openings. The first floor plan features numerous registers located to "kill" cold areas and drafts.

◆

In winter if either zone thermostat calls for heat, the oil burner starts and builds up steam in the boiler. This steam passes to the heating coil in the air conditioning unit and when the coil has reached a temperature of between 180 to 190 degrees, a temperature switch closes the circuit and allows the blower relay to start. With this operation of controls, it is not essentially necessary for the boiler to operate under pressure. As temperature only is required, the unit can operate on a vacuum. In summer the supply of cooling water is admitted to the cooling coil by a ¾-inch motor valve operated by the cooling thermostat for either zone.

Summer Cooling

For summer cooling city water was used. Last summer repeated tests showed that in July (the hottest month) the temperature never went above 55 degrees and was sometimes as low as 48 degrees. By manipulating the two thermostats the owner could cool the entire house or could shut off one zone thus getting more cooling capacity into one section of the house.

In replacing the first system all wall stacks were left in place; no changes were made in register locations on either floor, but the garage was cut off. All pipe work in the basement was removed and a two-zone piping system was installed. All first floor rooms and the second floor bathrooms are in one zone and the remainder of the second floor is in a second zone. The garage is now heated by direct radiation and is controlled by a motorized valve and separate thermostat.

Velocities in the main ducts are approximately 700 f.p.m.; in branches 600 f.p.m.; at registers 300 f.p.m. The first and second floor plans show room dimensions, c.f.m. requirements and location of registers.

◆

Correcting cfm For Temperatures Other Than 70°

CUBIC feet per minute is generally computed for a 70 degree temperature, and rules enough are available for this purpose; but occasionally it is necessary to measure the cfm at register temperature or outside temperature or a room temperature other than 70 degees.

It is a known law that air or any other gas under constant pressure expands when heated so that the volume of any definite weight will be proportionate to its temperature as reckoned from absolute zero, which is 460 degrees below the Fahrenheit zero.

Having computed the cfm at 70 degrees, in order to ascertain the cfm at any other temperature—say 150 degrees—the following solution will serve for all cases:

$$\frac{150 + 460}{70 + 460} \times \text{cfm at 70 degrees} = \text{cfm at 150 degrees.}$$

Whatever the desired temperature may be, simply substitute it for 150 in the equation above.

Humidity in House Heating* [Part 2]

Measurement of Relative Humidity

HUMIDITY measuring instruments vary from the novelty type giving approximate information, and generally known as hygroscopes, to the highest grades of hygrometers of the recording type giving a continuous record of the most accurate humidity information. Those suitable for household use may be divided into two broad classes.

Instruments of the first broad class employ substances that are sensitive to moisture such as hair, catgut, and whalebone. The cheaper instruments of this class give only a general indication of the moisture content of the air and are thus not of much practical value. The better instruments of this class (Figure 2) are accurate and reliable, provided that comparison is made from time to time with a standard instrument to make certain of correctness of adjustment.

Instruments of the second broad class combine two thermometers, one of which is arranged to give wet bulb temperatures (Figure 3), or employ a single thermometer arranged to give both wet and dry bulb temperatures. The accuracy of humidity determination made by a hygometer of this class depends therefore upon the accuracy of the thermometers of the instrument. Both dry and wet bulb temperatures are read (the latter being the lowest reading obtainable on the wet bulb thermometer on vigorously fanning the instrument with a fan or sheet of cardboard) and the corresponding relative humidity is taken directly from prepared tables or charts. One variation of this class is the swing psychrometer in which highly accurate dry and wet bulb thermometers are arranged to swing about a swivelled handle or at the end of a short chain (Figure 4). It is used where an easily portable instrument giving determinations of the greatest accuracy is required. Hygrometers of the dry and wet bulb type are simple in construction, are not unduly expensive, and may be used by anyone who can read a thermometer.

Fig. 2—Hygrometer using substance sensitive to moisture changes.

Some types of household thermometers may be adapted to give wet bulb temperatures as explained in the Appendix, which also explains how a hygrometer may be improvised from two ordinary household thermometers, and includes a table showing relative humidities corresponding to the usual range of wet and dry bulb temperatures under average conditions of house heating.

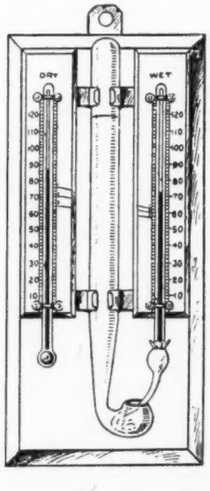
In measuring the relative humidity in a room care must be taken to place the hygrometer at some point where air conditions are approximately average for the room. The point selected should be between four and five feet from the floor and at some little distance from radiators, hot-air registers, and outside walls, and should not be in an appreciable draught.

Humidification Equipment

Since air dryness in houses is the direct result of artificial heating, the obvious remedy is the provision of humidifying apparatus that will operate in conjunction with the heating equipment. Such an arrangement tends to be automatic in operation inasmuch as the quantity of water which must be evaporated for the maintenance of healthful humidity conditions is determined by essentially the same factors as determine the quantity of fuel that must be burned to maintain the normal comfort temperature, viz., outdoor temperature, ventilation, air leakage, winds, etc.

Where it is not practicable or convenient to install humidifiers to be operated in conjunction with the heating equipment, humidification of indoor air may be readily effected by the use of humidifiers independently operated.

Heating equipment in common household use is of two different types. First is the radiant type in which the fuel is burned in a stove and the heat therefrom radiated directly into the room, or in a boiler from which the heat is conveyed by steam or hot-water



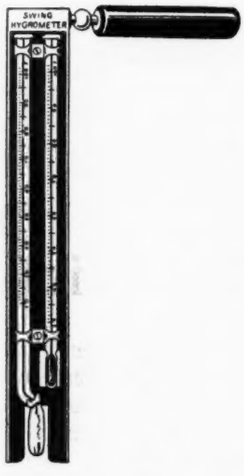


Fig. 3—At left a typical wet and dry bulb humidity recording instrument which must be fanned for accurate reading.

Fig. 4—At right a sling psychrometer with wet and dry bulb thermometers. To read, the instrument is swung vigorously by the handle.

*A booklet by the same name, published by the Resources Intelligence Service, Department of the Interior, Canada, and distributed by The Dominion Fuel Board. Five cents per copy. Reprinted by permission.

circulation to radiators and thence radiated directly into the room as before. Second is the air-circulating type in which the fuel is burned in a warm-air furnace and the heat conveyed to the various rooms by the circulation through the furnace jacket of the air of those rooms. Humidifiers for use with each of these types have been devised and made available.

Household humidifiers may therefore be divided into two broad classes, as follows, the first class being further subdivided as indicated:

I. Humidifiers operated in conjunction with heating equipment of:
   (a) air circulating type.
   (b) radiant type.
   (c) either type.

II. Humidifiers operated independently of the heating equipment.

Influence of Air Flow on Humidification

The flow of air within a house during the heating season is subject to many influences and is thus very complex in character. Air rises when heated and falls when cooled. Thus in a closed space, as a room, a definite circulation of air is created by supplying heat at one point and abstracting it from another.

In a house, heat is supplied either by means of a warm-air furnace, or by stoves, hot-water or steam radiators, electric heaters, etc., while it escapes through the walls, windows, doors, and roof, thus providing the necessary conditions for air circulation. In addition, fresh cold air is constantly entering the house by infiltration through the walls, through cracks around windows and doors, and by way of such ventilation facilities as may be provided, the displaced warm air leaving through similar channels. The rate of air change is dependent not only upon the character of construction of the house walls but also upon the strength of the wind and upon the difference between outdoor and indoor temperatures. This air change provides another definite circulation of air within the house.

The division of the house into a number of rooms, each of different exposure, at different elevations, interconnected by openings varying in size as the doors are opened and closed, and maintained at different temperatures, further complicates the air circulation within the house by adding the circulations between these various rooms.

With a well designed air-circulation heating equipment using a warm-air furnace, the cool air is conducted through "cold-air" ducts to the furnace jackets, where it is heated and distributed throughout the house by means of the hot-air leaders and registers. This type of equipment serves thus not only as an air heater, but also as an air mixer. Uniform humidification to the desired degree can therefore be readily accomplished by the evaporation of the necessary quantity of water into the air circulation at the point where it is concentrated, viz., in the furnace jacket.

With the other types of heating equipment in common use in which each room is heated by means of its own hot water or steam radiator or stove, there is no such definite circulation of air throughout the house, although the circulation within each room may be just as positive. The uniform humidification of air throughout the house is therefore a more difficult problem to solve. Theoretically, each room should be provided with its own humidifier. However, practical considerations of cost and convenience compel the adoption of a compromise. A study of the air-circulation conditions in each individual case would enable the selection of the one, two, three, or more points at which moisture should be supplied to give fairly uniform and ample humidity conditions. It is usually found that the selection of these points in or near the most important heating elements in the principal living rooms and main halls will give effective results. Care should be taken, however, that they are not subject to cold draughts which would result in condensation of moisture on the adjacent wall or on the floor.

Humidifiers in Warm Air Furnaces

Warm air furnaces are generally considered as particularly productive of air dryness in houses. This method of heating employs the air of the house to convey the heat from the fuel to the various rooms. Large quantities of warm air issue from the registers at high temperatures (150 degrees or more) which

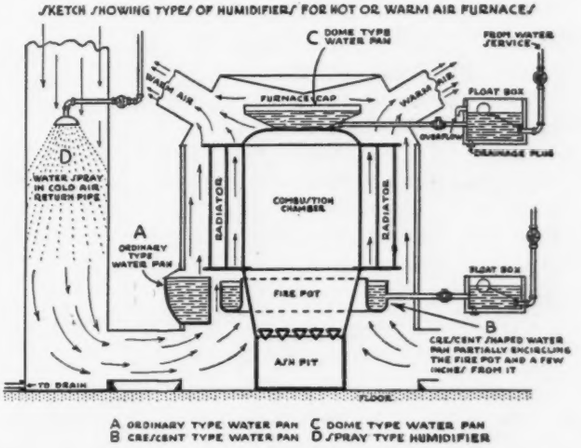


Fig. 5—Showing various humidifying pans or apparatus commonly used with warm air furnaces and methods for maintaining water supply.

while very dry at those temperatures are no drier when reduced to normal room temperature than would be the case with hot water or steam heating.

One of the important advantages of this type of heating equipment is the ease with which ample humidification may be effected. The evaporation of water into the air circulation is a very simple matter.

All warm air furnaces are equipped with water pans, usually placed beside the fire-pot near the firing door, and filled by hand (Figure 5A). In very many cases, however, the quantity of water evaporated from these pans is so small by reason of restricted water surface and unfavorable location that little benefit results.

Some warm air furnaces, however, have provision for the more ample humidification of the air circulation.

(*Continued on page* 62)

Forced Air Heating Facts From the Research Residence

By S. Konzo

Special Research Associate

Engineering Experiment Station

University of Illinois

Design of Forced-Air Heating Systems

Introduction

IN the preceding issue the general principles governing the loss of pressure head in a duct were discussed. The method of determining the pressure loss in a duct conveying air was also explained in detail. In the following discussion the principles and method which have been presented will be frequently used.

In general, the methods of design may be groupd into three classifications consisting of:

(a) velocity method,
(b) equal pressure method,
(c) modified methods.

Each of these methods may in turn be considered as applying to trunk systems and individual duct systems. In the latter, the heated air from the furnace is conveyed in individual ducts to each register, whereas in the former two or more of the branch ducts are served from a trunk duct. In this article the discussion will be confined to only one of the methods of design. The elements of design, including the advantages and disadvantages of the method, will be considered.

A. Velocity Method—Individual Duct System

One of the simplest methods of designing a forced-air duct system is that which may be designated as the "velocity method utilizing individual ducts." This method is characterized by its simplicity and is particularly adapted to the design of duct systems for small, compact houses and buildings. In this method the air velocities in each duct and at the register face are selected first, and the pressure losses are determined after the duct sizes have been selected. In order to show the method more clearly the following outline of procedure is presented:

Procedure in Design for:

A. Velocity method.
1. Individual duct system
a. Non-standardized sizes

1. In Fig. 1 it is assumed that four rooms, indicated by a, b, c and d, are to be supplied by warm air from the furnace F. The method of determining the air volumes required for each room has been discussed in a previous article and hence will not be presented in this article. The locations of the warm-air registers for each room are as indicated in Fig. 1.

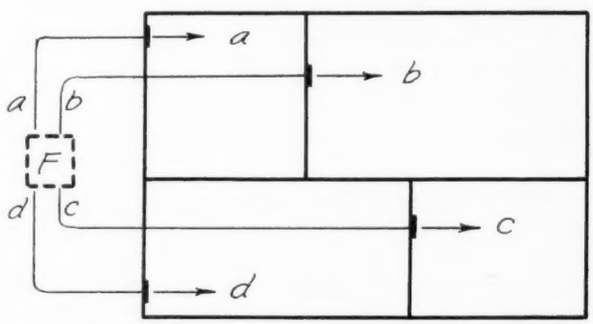


Fig. 1—Simplified line diagram showing an individual duct system. (See text for method of calculating duct sizes.)

Since examples showing numerical values will be more readily understood, it is assumed that the air volume requirements for rooms a, b, c and d are 200,

TABLE 1

Typical Example of Calculation Procedure

		A. Velocity Method		1. Individual Ducts		a. Non-Standardized sizes				
1	2	3	4	5	6	7		8	9	10
Room	C.f.m.	Equivalent Length, Ft.	Assumed Duct Air Velocity, f.p.m.	Required Duct Area Sq. Ft.	Sq. In.	Duct Size, In. Depth	Width	Equiv. Round Duct, Dia., In.	Friction Loss for 100 Ft.	Actual Friction Loss
a	200	20	500	0.4	58	8	7.25	8.4	0.080	0.016
b	400	40	500	0.8	115	8	14.38	11.7	0.056	0.022
c	150	50	500	0.3	43	8	5.38	7.2	0.098	0.049
d	300	20	500	0.6	86	8	10.75	10.1	0.065	0.013

400, 150 and 300 cu. ft. per minute, respectively. These values are listed in column (2) of Table 1.

2. Indicate the duct connection from the warm-air registers to the casing of the furnace. In Fig. 1 these ducts are indicated by the letters *a, b, c* and *d*. Determine the equivalent length in feet of each duct, assuming that each right angle turn is equivalent to approximately 10 diameters of the pipe. Since the duct diameter is as yet undetermined, an approximation must be made in the equivalent length of the duct.

In the numerical example it is assumed that the equivalent lengths are 20, 40, 50 and 20 feet for ducts *a, b, c* and *d*, respectively. See column (3) in Table 1.

3. Select some value for the air velocities to be maintained in the ducts. Assume in the numerical example a value of 500 feet per minute, as shown in column (4) of Table 1.

4. Calculate the required cross-sectional area of the ducts *a, b, c* and *d* by the following equation:

$$\text{Duct area, sq. ft.} = \frac{\text{Volume in cu. ft. per min.}}{\text{Velocity in ft. per min.}}$$

In the numerical example shown in Table 1 the required cross-sectional areas (columns 5 and 6) are obtained by dividing the values listed in column (2) by the values in column (4). For example, for duct *a* the required duct area is $200 \div 500 = 0.4$ sq. ft. or 58 sq. in.

5. Determine the duct sizes from the values of the duct area.

Determining Round Pipe Sizes

In the numerical example shown in Table 1 it is assumed that rectangular ducts having a uniform depth of 8 inches would be desirable. The required width for each duct can be determined by dividing the values listed in column (6) by 8.0. For example, for duct *a* the required width is equal to $58 \div 8 = 7.25$ in. Therefore, use a duct 8 in. x 7.25 in.

The equivalent diameter for a round duct can be obtained from Fig. 2. This value is the diameter of a round duct in which the friction loss per foot of run is equal to that for the rectangular duct. It is found necessary to obtain this value for the diameter of the equivalent round duct, since the friction charts are based in terms of round ducts only. (Fig. 2 on next page.)

In the numerical example the values for equivalent round duct are listed in column (8) in Table 1. In Fig. 2 follow the ordinate for 7.25 upwards until the intersection with 8 is obtained. Follow across to the left to obtain a value of 8.4 in. diameter for duct *a*.

Similarly, for duct *b* follow the ordinate for 8.0 upwards to a value of 14.38. Follow across to the left to obtain a value of 11.7 in.

6. Determine the friction pressure loss in each duct from the friction loss chart. See details in the previous article. The value for the friction loss per 100 feet of duct may be obtained from the known values for the air quantity and the equivalent round duct diameter. For the numberical example shown in Table 1 these values are listed in column (9).

The actual friction loss in each duct may be obtained as follows:

$$\text{Actual friction loss} = \text{Loss per 100 feet} \times \frac{\text{Length of duct}}{100}$$

The numerical values for the example are listed in column (10). It may be noted in this example that the greatest friction loss was obtained for duct *c*. In case this loss for duct *c* is greater in magnitude than that which is desired, the value of the assumed duct velocity may be decreased from 500 ft. per minute to a lesser value and a larger value for the duct size may be obtained.

It may also be noted that the friction losses for ducts *a, b* and *d* are much less than the loss for duct *c*. In order to equalize these pressure losses and to raise them to the same value as that for duct *c*, either the ducts may be reduced in size by assuming a higher value of the air velocity in the ducts, or cross dampers may be used to introduce the necessary resistance. Ordinarily, in small installations the latter method is used on account of its simplicity.

7. Determine register size by the following equation:

$$\text{Free area of register, sq. in.} = \frac{\text{Air volume, c.f.m.}}{\text{Register velocity, f.p.m.}}$$

It may be noted that if the assumed register air velocity is less than the air velocity in the ducts, a register whose dimensions are larger than the duct will be necessary. Unless care is taken to spread the air over the entire face of the register by means of directional vanes, a portion of the register face will be found to be ineffective. Ordinarily, therefore, it is advisable to use an assumed value for register air velocity equal to or slightly greater than the air velocity in the ducts. For velocities exceeding 300 ft. per minute it should be understood that directional flow or deflecting type registers are necessary.

Advantages of Method A-1-a

The advantages of this method of design may be itemized as follows:

1. The method of design and the actual installation of the duct system are both characterized by simplicity. In fact, this method may be regarded as an approach towards standardization in duct design and layout. Some systems which will be described later are modifications of this method and are even simpler in treatment.

2. The method is particularly adapted to smaller installations, in which the warm air pipes are short. The method is better adapted also to those installations in which the furnace is located near the center of the house.

3. The ducts are designed for a definite maximum velocity. In the example shown the maximum velocity occurred in duct *c*. Although the velocities in the other ducts were all assumed to be 500 ft. per minute, in the actual installation after the dampers have been adjusted the velocities will all be less than 500 ft. per minute.

4. The sheet metal work is extremely simple and hence the cost of installation will probably be less than in some other types of systems.

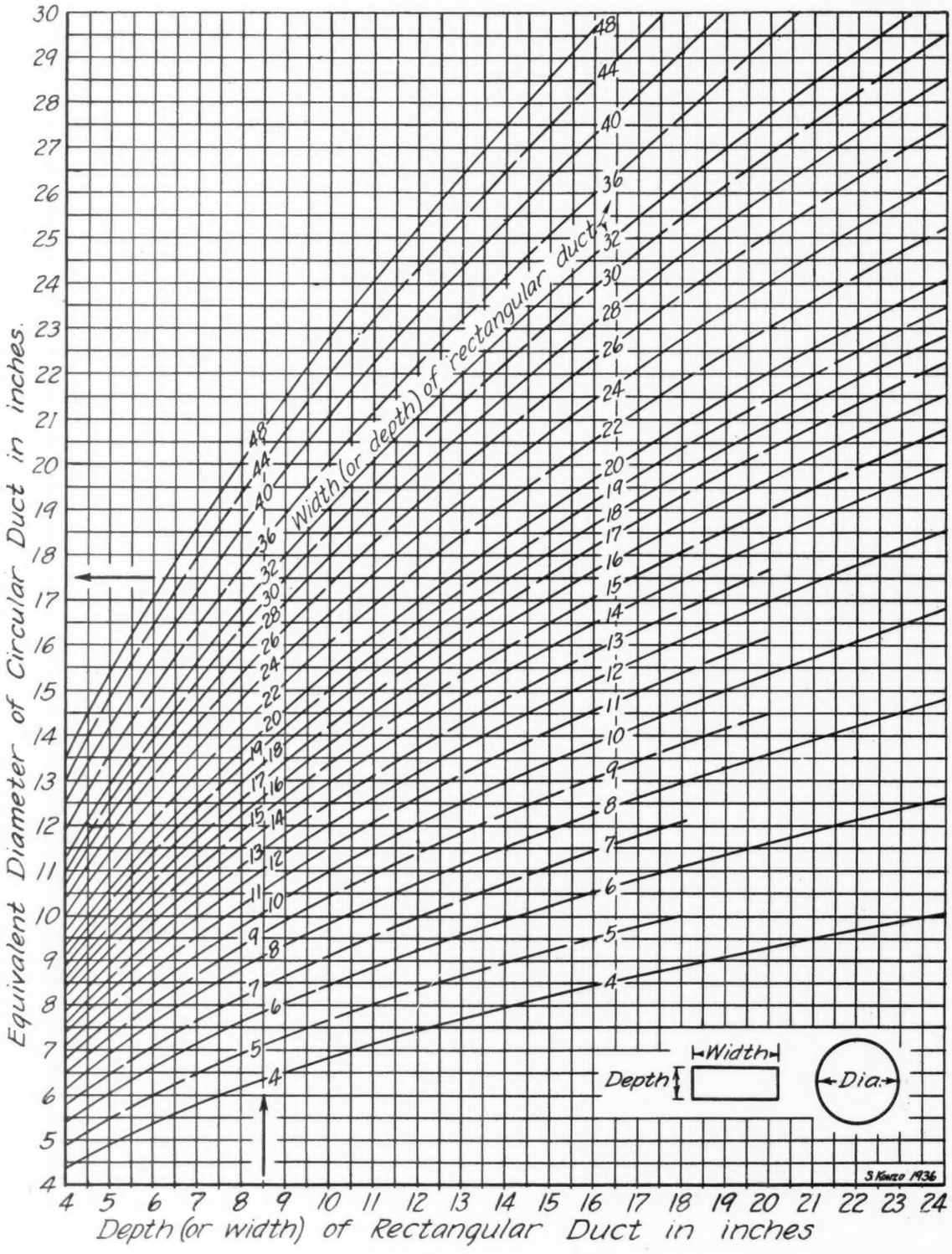


Fig. 2—Chart showing circular equivalent of rectangular ducts.

5. It is possible by grouping the individual ducts and by running them parallel to each other to present a workmanlike, compact and neat installation. The use of a high bonnet with the ducts taken off near the top is recommended, since no bends will be required in the ducts at the take-off.

6. The balancing of the ducts and the regulation of the air flow is relatively simple if a cross damper is placed in each duct. Since each duct supplies air only to a single register, any adjustment of the damper will not affect the air flow in other ducts to the same extent as it does in an ordinary trunk system.

TABLE 2

Typical Example of Calculation Procedure

A. Velocity Method **1. Individual Ducts** **b. Equal Total Pressures**

a. First Step

1	2	3	4	5	6	7		8	9	10
Room	C.f.m.	Equivalent Length, Ft.	Assumed Duct Air Velocity, f.p.m.	Required Duct Area Sq. Ft.	Sq. In.	Duct Size, In. Depth	Width	Equiv. Round Duct, Dia., In.	Friction Loss for 100 Ft.	Actual Friction Loss, In.
a	200	20								0.049
b	400	40								0.049
c	150	50	500	0.3	43	8	5.38	7.2	0.098	0.049
d	300	20								0.049

b. Second Step

1.	2	3.	4	5.	6	7.		8	9	10
Room	C.f.m.	Equiv. Length ft.	Actual friction loss, in.	Friction loss for 100 ft.	Equiv. round duct dia.	Duct Size, in. Depth	Width	Duct area Sq. in.	Sq. ft.	Duct air velocity f.p.m.
a	200	20	0.049	0.245	6.7	8	4.8	38.4	0.27	740
b	400	40	0.049	0.122	9.9	8	10.3	82.4	0.57	702
d	300	20	0.049	0.245	7.8	8	6.4	51.2	0.36	834

Disadvantages of Method A-1-a

The disadvantages of this method of design may be summarized as follows:

1. When the duct sizes are determined by the method of equal velocities, the size of ducts in all of the runs, except that one which has the largest friction pressure loss, will be too large. This offers no particular difficulty in making adjustments in the distribution of air flow. However, the material for fabricating the ducts will not be used economically, unless adjustments are made to reduce the size of ducts in every case except that which has the greatest friction pressure loss.

A modification of this method in which the size of each duct is calculated so that the total pressure in each of the individual ducts will be the same as that for the duct having the greatest resistance is described in detail in part A-1-b in this article.

2. This method is not adapted to large installations in which a great number of registers are served from the furnace. Also it is not suitable for installations having many long ducts, since the amount of material required in fabrication, for example, for five long individual ducts will be much greater than the amount of material required for a single trunk serving all five registers.

3. The heat loss from the duct to the surrounding air will, for a given quantity of air delivered at the registers, be greater for the individual duct system than for the trunk duct system.

4. In this type of installation in which the small individual ducts are all connected to the bonnet, the entry loss to the duct may be of considerable magnitude. The use of a suitable transition piece at the bonnet outlet, as shown in Fig. 3, is recommended.

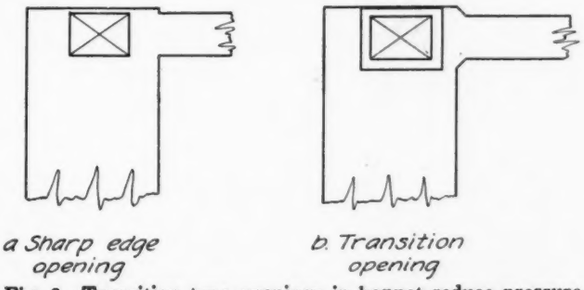


Fig. 3—Transition type openings in bonnet reduce pressure loss in the duct system. (See text for explanation.)

Entrance Losses

In this connection the values given in Harding and Willard's book for pressure losses in pipes are of interest. The pressure loss for a "plain entrance" to a pipe is 0.47 times the velocity pressure, and the pressure loss for a "coned entrance" to a pipe is 0.20 times the velocity pressure.

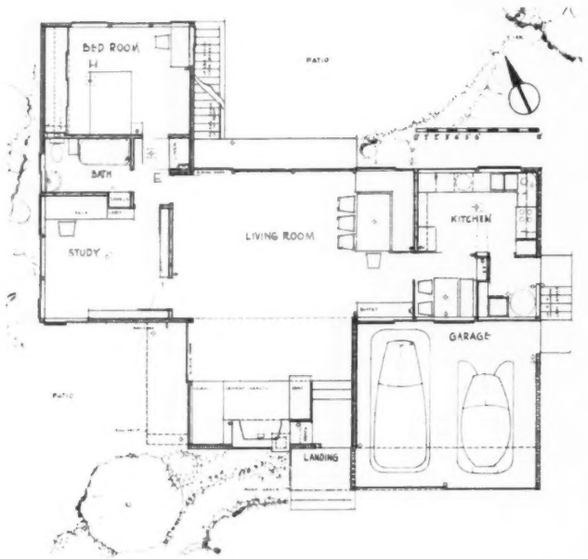
That is, if a loss of one velocity head is assumed as qual to the loss in a length of pipe 50 diameters long, nen the loss in a "plain entrance" is equivalent to 23.5 diameters of pipe, or is approximately equal to the loss of three right angle elbows. Also the loss in a "coned entrance" is equivalent to 10 diameters of pipe, or is approximately equal to one right angle elbow. In general for all duct construction, the "coned entrance" or the "transition opening" shown in Fig. 3 is to be preferred to the plain entrance, particularly for those cases in which the pressure loss is to be maintained at a minimum value. Obviously for those cases in which the pressure loss in the duct is small and in which additional resistance is necessary in order to restrict the air flow in a duct, the use of the simpler plain entrance is sufficient.

5. It may be noted that the pressure resistance in the warm air supply ducts which is used in selecting the fan is dependent entirely upon that which is largest in magnitude.

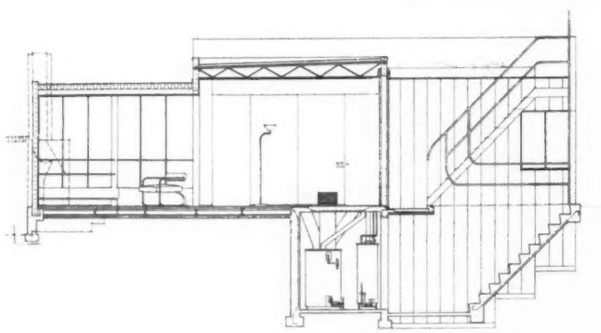
In the numerical example shown in Table 1, for instance, the resistance of the entire warm air duct system may be regarded as equal in magnitude to the resistance for duct *c*. Therefore, special attention should be directed towards that duct having the greatest resistance. If a large discrepancy in magnitude exists between this greatest resistance and the resistances for the other ducts, then it is good practice to make some provision for reducing the magnitude of the largest resistance. This may be accomplished by increasing the size of the duct having the large resistance. The dis-

(*Continued on page 72*)

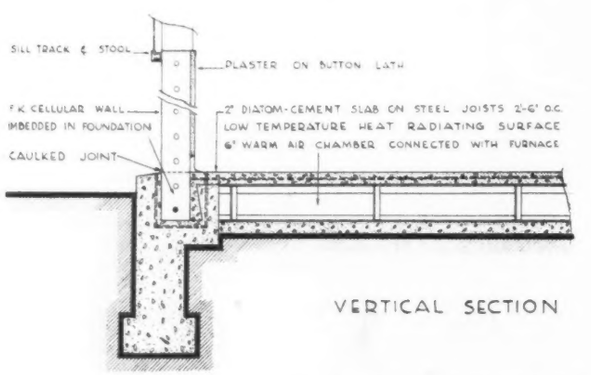
Floors, Walls and Ceiling of this House Are Heating Surfaces



The idea of the architect is to insure the maximum amount of usable floor space with huge window areas which may be rolled open to the outside. All walls are hollow and warm air passes up through them by gravity flow.



Practically the only basement is the heater room. The furnace connects into the floor plenum as shown here. For rapid warming up the furnaces supply warm air through ordinary registers.


SILL TRACK & STOOL
PLASTER ON BUTTON LATH
F.K. CELLULAR WALL IMBEDDED IN FOUNDATION
2" DIATOM-CEMENT SLAB ON STEEL JOISTS 2'-6" O.C.
LOW TEMPERATURE HEAT RADIATING SURFACE
6" WARM AIR CHAMBER CONNECTED WITH FURNACE
CAULKED JOINT
VERTICAL SECTION

This floor and wall cross section show the floor plenum and the hollow walls up which the air flows by gravity to the shallow attic space. The air is vented from the attic. There is no return to the furnace.

By J. Edw. Tufft

WHAT is said to be the first residence in California, so built that the entire floor, walls and ceiling are radiating panels, has been erected at 1881 Meadowbrook Road, Altadena, California, for William Beard, teacher in the California Institute of Technology, the architect being Richard J. Neutra, Los Angeles.

The house is a steel-built structure with 1,200 square feet of floor space.

The ground floor is of double shell, concrete construction and has a 10-inch, over-all depth. The upper slab is 2-inches thick and is integrally colored. It is of waxed diatom cement composition and is carried by cross-braced, trussed, open-web steel channel studs. The lower slab lies on the ground and is of equal thickness.

The Floor Plenum

The 6-inch plenum chamber between the two slabs extends under the entire building. Into this chamber the heated air from the two gas-fired furnaces flows by gravity. The floor slab thus will act as a low-temperature, radiating panel. A retarded convection carries the air from the floor plenum into the vertical hollows of the cellular steel walls, thence to the shallow attic where it finds eventual exits through a roof vent.

Mr. Neutra points out the advantages of this type of heating system. The first advantage is the fact that the human body will be comfortable even though thermometers at the breathing level register comparatively low temperatures, because the body is receiving heat by direct radiation from floor, walls and ceiling, thus offsetting bodily radiation and is far less dependent for comfort on surrounding air temperatures. That, Mr. Neutra explains, is the reason why Swiss ski riders in the Alps are comfortable in bathing suits when the temperature is below zero. The answer there is direct radiation of the sun.

Room Arrangement Features

The maximum amount of space in this house is allotted to living quarters, practically all rooms in the house opening to an outdoor patio by means of great sliding glass doors and steel partitions. As long as the wind is not blowing, perfect comfort is experienced with the house open to the mountains on winter days. The plan aims at the maximum of outdoor living.

There is also economy in the plan for the colder

(*Continued on page* 75)

The Experiences of one Oil Burner Dealer In Selling Summer Cooling

By S. S. Swift
Swift Lumber & Fuel Co., Lincoln, Nebraska

SOME twenty years ago, our company started in the burning oil business, because we found that many of our better customers were changing their heating plants from coal to oil. Later on, we found that the old gravity burners were not all that their manufacturers claimed for them; that we had to maintain a service department and eventually, an installation department because service men needed employment in the summer.

We Sold Burners and Heaters

We have gone through all the changes in the oil burner business, installing almost every kind of oil burner and servicing not only the burners we installed, but many other burners where we supplied the oil.

Eventually, we found it necessary to sell furnaces, boilers, hot water heaters, unit heaters and various other pieces of equipment necessary to heating. All of these things have come upon us gradually and in the natural course of events.

During the past two or three years, air conditioning has come in, that is, summer cooling. With the advent of this new phase in the business, we have encountered many problems.

Why We Sell Cooling

There are many reasons why the oil burner dealer or the heating contractor should consider summer cooling. For years the customer for an oil burner, new furnace, new boiler or any other piece of heating equipment, has delayed his purchase in summer and in spite of the most strenuous efforts on the part of the salesman, he has been practically impossible to close until late in the fall. This has resulted in an unsatisfactory condition for the dealer. In the first place, the sales department became dissatisfied during the summer months and drifted to other fields of endeavor. The installation department, being unemployed in the summer, was unprofitable to maintain.

All year round air conditioning, however, seems to offer a solution for these problems. In other words, the customer who is contemplating revamping his heating system to include 100 per cent air conditioning is more approachable than ever before, in the spring of the year and early summer months.

Information on air conditioning is often given in language too technical to be easily understood by the beginner in this business and therefore he feels that he must have a lot of technical training to undertake it.

The installation of any kind of summer cooling contemplates the installation of blowers and coils and, of course, an adequate duct system to convey the air delivered by the blower to the various spaces to be cooled.

Some Cooling Problems

The dealer who is contemplating installations of this kind has many perplexing problems to consider and unfortunately the industry is so young that, not only is he compelled to guess regarding the heat load in the spaces he contemplates conditioning, but he is also compelled to guess regarding the heat absorption ability of the equipment he contemplates installing. Of course, it is possible to compute this heat load, just as he would in heating, but because there are more variables it is much harder to figure accurately than heating. Any system of figuring the number of B.t.u.'s necessary to remove from any space is only an intelligent guess and some times not too intelligent. Any honest engineer will admit this.

Equipment Ratings

In the past, we have felt quite sure regarding the heat output of any good furnace or boiler. In other words, a boiler rated to carry 1000 feet of steam will live up to its rating; a furnace rated to deliver 150,000 B.t.u. at the bonnet will deliver that rating; a unit heater rated at 200 feet of steam radiation, will deliver its capacity.

This is not always true of blowers and coils. Blower fans rated to deliver 1000 cubic feet of air per minute, will not always deliver that air. The effect of static pressure (pulling through coils and delivering through ducts) is an uncertain quantity. Coils, rated by manufacturers to absorb 10,000 heat units per hour, under certain conditions, will not absorb their rated capacity.

The cost of refrigeration compressors for air conditioning is in many instances prohibitive.

The effect of cooling any given space is naturally

changed by a wetness or dryness of the air, as well as by the rapidity of circulation.

Comfort cooling for residences, offices, small shops and work rooms is undoubtedly here to stay. The public is very rapidly becoming sold on a conditioning of air that will make it comfortable and pleasant for them during the very hottest days, as well as during the very coldest days.

Reasonable Cooling Results

A lot of misinformation is being given by manufacturers, who have axes to grind. The only practical method of comfort cooling is the circulation of air through a coil which has been cooled by the circulation of some medium. This medium can be water or any other liquid that will run through the tubes of a coil. It can be refrigeration gas or any other gas that will pass through the coil, so long as that medium is cold enough to absorb the heat the air carries.

A temperature of 80 degrees with a reasonable relative humidity condition and a reasonable amount of air movement is comfortable for any one to live or work in, when outside temperatures are 100 degree F. or higher. A differential of 20 degrees below outside temperatures, advocated by some authorities, is not always satisfactory. After all, 95 degrees F. is hot in any country, or in any language, and this summer we had temperatures recorded by the government, officially, of 115 degrees F.

Water, that is 60 degrees F. or colder, is a good medium for summer cooling and where water is plentiful and cheap, it is unquestionably the best possible medium, because it costs less to install, it costs less to operate and it is the simplest to service.

Coil Problems

The effectiveness, that is, the heat absorbing value, of any given coils, is of course, dependent first: upon the number of square feet of surface in that coil; second: upon the volume of air passing through the coil; third: upon the quantity of water passing through the tubes of the coil; fourth: upon the velocity of the air and water passing through the coil.

Eventually, we will have complete data on all of these factors. At the present time, we must get our information largely by tests and trials.

The absorption of 12,000 heat units per hour is considered one ton of refrigeration. Our experience has led us to believe that for every 12,000 heat units per hour we wish to absorb with water coils, we must have 125 square feet of coil, 1,000 cubic feet of air per minute and 1½ gallons of water per minute, at a temperature of 60 degrees or colder.

In many instances, we do not use all this air. The space we are cooling is too small in cubical contents to accommodate it, without excessive air movement. We can always reduce our air flow by slowing down our blower, but when our blower has reached its capacity, we can't increase our air movement without objectionable results, such as noise, high velocities, etc.

Another thing that has proven to be important is the thickness of the coil, through which we pull our air. Of course, the velocity has something to do with this, but we find it advisable to have 20 inches or more of close finned coils, preferably eight tubes or more deep.

When we set up a job for comfort cooling, we do not feel satisfied unless we are putting into the water, which we deliver through our coils, 10 or more degrees of heat. In many instances, we deliver 12 or even 14 degrees of heat into the water without detriment.

Relative Humidity

We realize that relative humidity is a more important factor in some markets than it is with us. When it is very hot in our market, it is also very dry. We try to build our jobs so that we can deliver slower velocity air, on comparatively cool humid days and higher velocity air during dry, hot spells. Of course, slower velocity air through a coil will come out colder, consequently producing drier results. However, the coil will not work as hard, therefore the water will not absorb as many degrees of heat.

We realize the advantages of electric refrigeration in comfort cooling jobs, but we also realize the sales resistance encountered, due to the cost of installation, as well as the cost of operation, service and up-keep.

The oil burner dealer, if he is not already engaged in summer cooling, is going to be compelled to go into it. The future home is to be 100 per cent summer and winter air conditioned. The dealer, who can intelligently sell and install 100 per cent summer and winter air conditioning, will merit the future business of the home owner.

Heat Losses For Clay Tile Roofs

IN some sections of the country tile roofs are quite common on old houses built 60 years or more ago. Tile were applied differently in those times and it is not unusual to find the underneath side of the tile exposed—in other words there is no roof sheathing or paper. That the heat loss for such construction is higher than the figures given in the ASHVE Guide is understood.

Just what the heat loss coefficient is may find some answer in a report on heat losses through tiled roofs by H. E. Beckett, describing studies made at the Building Research Station in England and published in the September, 1936, *Journal* of the *Institution of Heating and Ventilating Engineers.*

The following conductances were recommended by the author for adoption for practical use:

Recommended Air-to-Air Conductances for Tiled Roofs

(Btu. per Sq. Ft. per Hr. per F.)

Boarded and felted	0.85
On battens only	1.50
On battens, torched	0.95

Other types of tiled roofs are to be tested during the coming winter, but the boarded and felted roof will be retained as a standard of reference throughout the experiments.

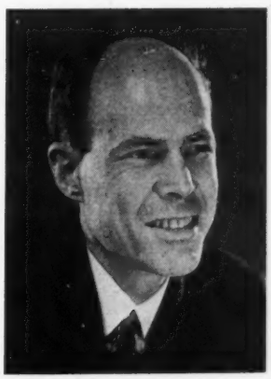
AIR CONDITIONING
TRENDS
JANUARY 1937
Issued From "AIR CONDITIONING HEADQUARTERS"
Keeney Publishing Co., Publishers of "Heating, Piping & Air Conditioning" and "American Artisan" • 6 No. Michigan Ave., Chicago
HOW IMPORTANT ARE THE UTILITIES TO YOUR SALES PROGRAM IN 1937
Power Company Executive Says Better Understanding is Vital to Growth of Air Conditioning
Stressing the "mutual interest" of the manufacturer of air conditioning equipment and the public utility industry which sees in air conditioning its most important load potential since the introduction of electric lighting, Robert S. Hitchcock, vice-president of sales for the General Light & Power Company, challenges both industries to work together for mutual profit in 1937.
In a thought provoking interview, Mr. Hitchcock said that neither the manufacturer nor the utility "have begun to
Air Conditioning TRENDS Makes its Bow
Air conditioning has emerged out of infancy and adolescence to the stature of a full grown industry within the span of a young man's business life time.
It is destined to enter upon a stage of commercial expansion second to few industries of our time.
The brilliant engineers who conceived and founded it are passing on the torch of leadership to an equally gifted group of sales-minded merchandisers and executives gifted with the "money sense" in management.
"Trends" is dedicated to those whose interest leans more heavily to the Sales Side of Air Conditioning. Each month it will

A MONTHLY NEWS BULLETIN to interpret the SALES SIDE of the AIR CONDITIONING Industry

● We believe sales, advertising and administrative executives in Air Conditioning can use to good business advantage a regular medium of information to reflect and interpret important sales trends in this fast-growing industry.

The engineering problems of the industry are being competently and adequately handled from a publication viewpoint. Similarly authoritative treatment of its sales and merchandising aspects is needed.

Where can the sales and advertising manager, the board chairman or the president put his finger on facts and trends that will assist him in charting a course through the troublesome and exciting days ahead?



BREWSTER S. BEACH

"Air Conditioning Trends," an informal monthly news bulletin to be issued by Keeney Publishing Company starting in January, has been designed to fill this need. Each issue of "Trends" will be devoted to one or more important and basically fundamental subjects that are of current interest to those responsible for the business development of Air Conditioning. Every month it will attempt to feel the commercial pulse of Air Conditioning and to report it for the benefit of executives who must keep abreast of the most progressive thought.

The editor of "Trends" will be Brewster S. Beach, public relations consultant of New York, formerly advertising manager and director of publicity of Carrier Corporation, who for many years has been prominently identified with industrial promotion.

"Trends" is not a commercial venture. It is a contribution and a service to better selling and promotion of Air Conditioning. It will be distributed each month with the compliments of "Heating, Piping and Air Conditioning" and "American Artisan" to selected sales, advertising and administrative executives within the industry.

"HEATING, PIPING and AIR CONDITIONING"
"AMERICAN ARTISAN"

PUBLISHED BY KEENEY PUBLISHING CO., 6 NO. MICHIGAN AVE., CHICAGO

Factors Affecting Fuel Saving

(*Continued from page* 44)

to consider the probable fuel saving that would be obtained in a typical two-story house, with unfloored attic space. For this comparison the data presented by C. G. Segeler* giving the relative amounts of heat loss from various parts of a house have been used. These values, which were an average obtained from analysis of 200 homes, showed that the proportions of total heat loss from the various parts of the house were as follows: 16.2 per cent through the roof, 27.0 per cent through the walls, 25.8 per cent through the glass, 24.6 per cent by infiltration, 4.3 per cent through the door, and 2.1 per cent through other sources, including the floor.

Heat Losses in a Typical House

For these calculations it was assumed that the total heat loss for the "typical" house during maximum weather conditions was 100,000 Btu per hour, composed of a roof loss of 16,200 Btu, a wall loss of 27,000 Btu, a glass loss of 25,800 Btu, an infiltration loss of 24,600 Btu, a door loss of 4,300 Btu, and a floor loss of 2,100 Btu per hr. (see item (a) in Table 3). In addition it was assumed that the wall section was composed of yellow pine lap siding, building paper, 1-in. fir sheathing, 3⅝ in. studding space, and wood lath and plaster, and that the ceiling adjacent to the attic space was composed of wood lath and plaster attached to unfloored joists. The over-all heat transmission coefficients for the uninsulated wall and ceiling were respectively 0.245 and 0.62 Btu per sq. ft. per deg. F. difference in temperature. The addition of 1-in., 2-in., 3-in., and 3⅝-in. thicknesses of mineral wool insulation having a thermal conductivity of 0.27 Btu per sq. ft. per deg. F. per inch of thickness, reduced the values of the over-all coefficient of heat transmission of the wall from the original value of 0.245 Btu to values of 0.129 Btu, 0.087 Btu, 0.066 Btu, and 0.060 Btu, rspectively. Similarly the addition of 1-in., 2-in., 3-in., and 3⅝-in. thickness of mineral wool reduced the values of the over-all coefficient of the ceiling from the original value of 0.62 Btu to values of 0.188 Btu, 0.111 Btu, 0.079 Btu, and 0.066 Btu, respectively.

The heat losses through the wall and the ceiling were reduced by amounts proportional to the reduction of the heat transmission coefficients, and the revised figures for the two losses were used in obtaining the total heat loss from the house for the various conditions listed in Table 3.

It may be noted from the values listed in Table 3, items, (b) and (e), that although the addition of the first inch of insulation to the original wall reduced the total heat loss from the house by approximately 12.8 per cent, the addition of 2⅝ in. more insulation reduced the total heat loss by only another 7.5 per cent. In the case of the wall insulation, the maximum reduction in heat loss amounting to 20.3 per cent (e) was obtained when the studding space was completely filled with insulation. Similarly in the case of the ceiling insulation, the maximum reduction in heat loss amounting to 14.5 per cent

*Discussion by C. C. Segeler in A.S.H. and V. E. Transactions of 1928, vol. 34, p. 473. The percentages of heat loss were average values obtained from an analysis of 200 homes heated with gas fuel.

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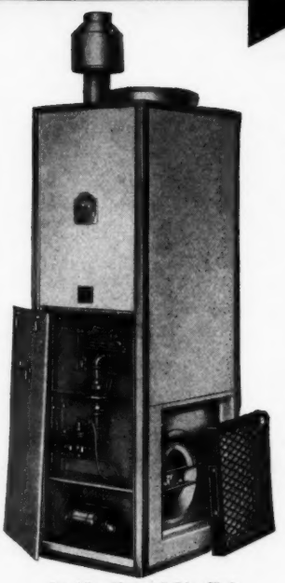

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(i) was obtained when the space between the joists was completely filled with insulation. When a layer of insulation 3⅝ in. thick was added to both the sidewalls and ceilings, the total reduction in heat loss from the house amounted to 34.8 per cent (j).

The reductions in heat loss obtained with the use of weatherstripping on all the windows and doors, and with the use of storm windows and storm doors, are listed as items (k) and (l) respectively. The maximum reduction in the heat loss from the structure, amounting to 66.1 per cent (m) was obtained when both the sidewalls and ceilings were insulated with a 3⅝ in. thickness of insulation, and the house was completely equipped with storm windows and storm doors.

CALCULATED HEAT LOSSES FOR TYPICAL RESIDENCE

Case	Insulation Wall	Insulation Ceiling	Weather Strip	Storm Sash	Calculated Hourly Heat Loss in Per Cent of Maximum Rate (0 20 40 60 80 100)	Reduction, %
a	None	None	None	None		0
b	1-in.	None	None	None		12.8
c	2-in.	None	None	None		17.4
d	3-in.	None	None	None		19.7
e	3⅝-in.	None	None	None		20.3
f	None	1-in.	None	None		11.3
g	None	2-in.	None	None		13.3
h	None	3-in.	None	None		14.1
i	None	3⅝-in.	None	None		14.5
j	3⅝-in.	3⅝-in.	None	None		34.8
k	None	None	Yes	None		9.8
l	None	None	None	Yes		31.3
m	3⅝-in.	3⅝-in.	None	Yes		66.1

Chart showing reductions in heat loss secured by various methods arranged by magnitude of losses. (See Table 3)

It is probable that these caclulated reductions in heat loss, which were based on maximum load conditions, may not exactly correspond to the fuel saving obtainable under ordinary weather conditions. The calculated values should only be regarded as maximum savings obtainable under conditions of full load. On the other hand, the calculated values for reduction of heat loss take no account of the change in comfort conditions resulting from the increases in temperature of the wall surfaces exposed to the occupant, the increase in air temperature in the living zone, and the reduction of drafts. Neither do they take into account the increase in comfort conditions in the summer resulting from the reduced house temperature.

It should be recognized that the return on the investment, whether that investment consist of storm sash, insulation, or any other fuel-saving device, depends not only on such factors as the cost of fuel, the cost of the heating equipment, and the severity of the weather, but also on whether the conservation measure is planned before the house is built or is adopted at a later date. In fact the greatest returns on the investment are obtained when the conservation measures are planned before the house is built, and the cost of the investment is partially offset by the decrease in cost of the heating equipment for the house.

The greatest reductions in fuel cost can be obtained by substantial improvements in the house structure, and such improvements should be given careful consideration in existing as well as in proposed structures.

[To be continued]

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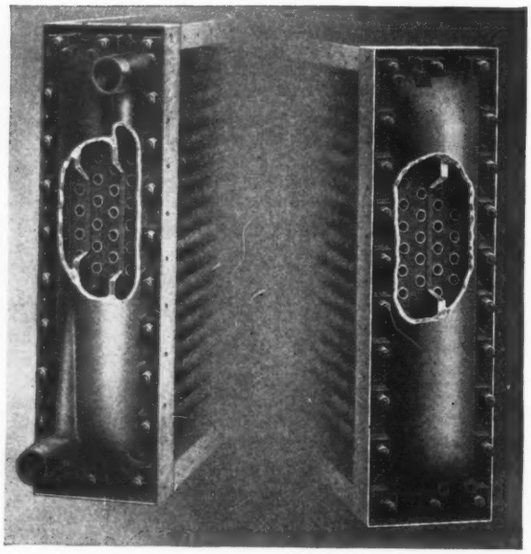

LEFT: Water connection end of unit showing baffles for 18-tube single pass. For 36 tubes double pass, center baffles only used. RIGHT: Rear end for 18-tube single pass. For 36 tubes double pass, baffle omitted.

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Humidity in House Heating

(*Continued from page* 51)

This may be in the form of a crescent-shaped water pan almost encircling the fire-pot (Figure 5B). This may be kept filled by hand, or the water may be automatically supplied by means of a float-box connected with the water service. Another type of evaporating pan used by some furnace manufacturers or made for installation on any furnace, is placed on top of the dome or combustion chamber and is also automatically supplied with water by means of a float-box (Figure 5C). Tests made by the University of Illinois show that this type of pan evaporates nearly a pound of water per square inch of exposed water surface per day, whereas under the same firing conditions the crescent-shaped pan evaporates little more than two-thirds of a pound, and the ordinary type less than half a pound in the same time.

Equipment of the dome type can be made and installed at a reasonable cost by any tinsmith or plumber using sheet copper or galvanized iron for making the pan and float-box. The pan should be made to provide a large water surface, and with the sides sloping as in Figure 5C, so that this surface may be adjusted to the needs of the house by changing the level of the water in the float-box. In determining the area of the water surface required in a water pan of this type the heating capacity of the furnace in use must be taken into account as well as the size of the house, since an undersize furnace operated with a hot fire will evaporate more water from a pan with a given surface than an oversize furnace operated with a slow fire.

[*Editor's Note—We believe that a much more satisfactory suggestion is to buy any one of the several types of automatic evaporating bonnet humidifiers as the manufactured units are more efficient, more positive and low in cost when advantages are considered.*]

A humidifying device of another type consists of a spray nozzle which is placed at the upper end of a vertical section of the principal cold air return pipe near the furnace (Figure 5D). This specially designed nozzle is connected with the water service and directs a fine misty spray vertically downward through the pipe moistening the air circulation as well as cleansing it of dust and soluble impurities. The surplus water is collected in a boot and drained into the house drains. This humidifier uses about 200 gallons or more per day (depending upon the pressure), of which it is claimed that from 10 to 20 gallons are evaporated.

Where it is not desired to alter the humidifying equipment on the furnaces, shallow evaporating pans may be supported on brackets or placed in shields over the warm air register in such a way as not to impede the flow of warm air. Large water surfaces are required on such pans in order to evaporate appreciable quantities of water, and wicks are usually arranged to obtain these large evaporating surfaces.

A simple makeshift humidifier may be assembled from material to be found in every house together with a few sheets of blotting paper and used to good effect with baseboard registers as follows: A bowl or pan holding half a gallon or more of water is placed on the floor in front of the warm air register. Long strips

of blotting paper are strung at one end on a piece of wire which is supported on brackets fastened either to the pan or to the wall (or which is bent to such shape that it can be clamped to the upper part of the register grill) so that the lower ends of the blotting paper strips hang into the water. The stream of warm air passing between the saturated strips rapidly evaporates the water in the pan. The blotting paper which is used to increase the evaporating surface may be replaced when it becomes unsightly by reason of staining from the impurities in the water.

Such auxiliary water pans are kept supplied with water by hand. The number required to give ample humidification can be determined only by checking results with a hygrometer.

Rigid Insulation

(*Continued from page* 45)

in all directions. Rigid insulation also provides a satisfactory plaster base, eliminating lath marks and minimizing cracks.

Summary

The conclusions set forth in this article may be summarized as follows:

1. When a fill type of insulation is installed between 2 x 4 studding, the thickness of insulation obtained is 3⅝". The opinion prevails that because the thickness is say 3½ times as great as say 1" of rigid insulation the effectiveness of the insulation is in this ratio. This is not so.

2. Insulating materials are governed by the law of diminishing return. Each succeeding layer or thickness applied "stops" less and less heat.

3. In the case of a standard frame brick veneer wall, the first ½" layer of insulation "stops" 30 per cent, the second layer 16 per cent, the third 10 per cent and so on. In other words, the first 1½" stops 56 per cent, whereas the next 2½" stops only 21.2 per cent additional.

4. Because of this diminishing return, the first 1" or 1½" of insulation shows the greatest return for money invested. In a theoretical case where 1" rigid insulation was used for sheathing and ½" rigid insulation for plaster base, the fuel saving due to the rigid insulation resulted in an annual return on the insulation investment of nearly 54 per cent. Under the same conditions the return on the investment was only 22.6 per cent using fill insulation batts, and 18.8 per cent based on the blow-in type of insulation.

5. The foregoing comparisons were based on the assumption that the full value of the fill insulation is obtained. In practice, the value of fill types of materials may be lessened by four factors, namely: (1) compression, settling, and bridging, (2) attenuation of ceiling insulation, (3) interstitial condensation, and, (4) loss due to framing members. Rigid insulation must be protected against moisture absorption since some cheaper types act like blotters in the presence of moisture.

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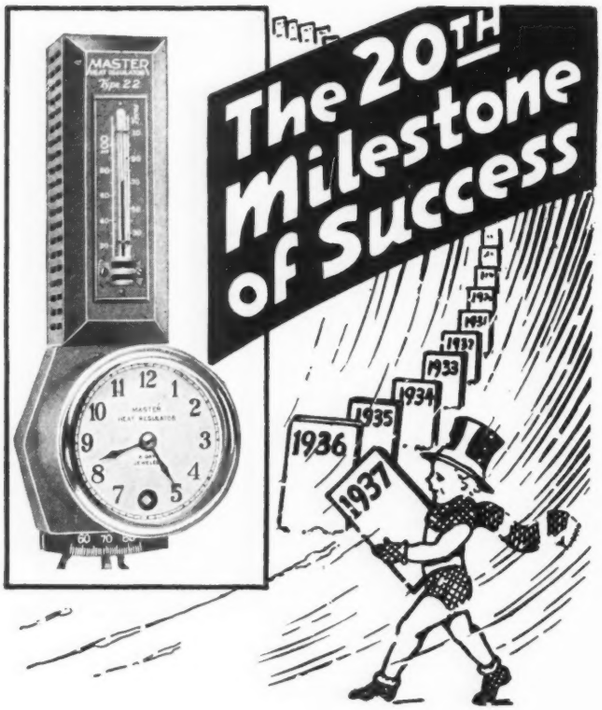

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Combustion in Stokers

(*Continued from page 47*)

of the retort, partly because of the increased bulk density of the coal containing the finer sizes and partly because of the natural tendency of the screw to push the coal up the inclined face of the retort. Uneven feeding to various parts of the retort is obviously undesirable.

Effect of Heat on Coal

Figs. 2 and 3 have been prepared as a basis for the discussion of the effect of heat on the coal as it rises into the burning zone, and of the subsequent carbonization and combustion; Fig. 2 represents a fuel bed with a relatively free-burning coal, and Fig. 3 a fuel bed of a strongly caking coal. These figures are not idealized; they are diagrammatic sections of actual fuel beds obtained by observation during the course of burning tests and by careful disassembly of the beds at the close of the tests. They show the segregation of the coal in

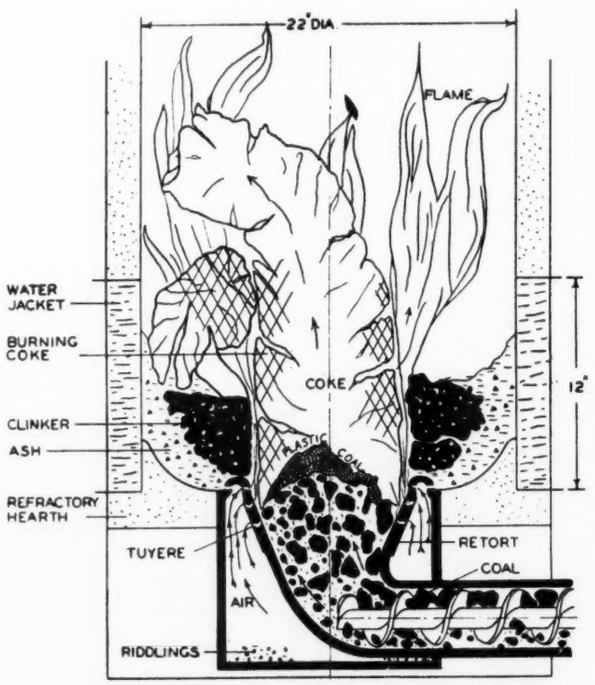

Fig. 3—Cross section of retort and fuel bed with strongly caking coal.

Intermittent operation. Coal size 1¼ in. to 0. Btu per hour heat release, 187,500; 85 per cent excess air; feed rate, 34 lb. per hour.

the feed tube and the retort with the fines at the bottom of the feed tube and back of the retort (left-hand side) and the coarse at the top of the feed tube and front side of the retort. The zone of plastic coal, the incandescent and black coke, the fine ash and the fused clinker, and the flames, are shown.

Because of the segregation of the sizes of coal and possibly uneven feeding, there will be some difference in the actions occurring at the front and rear of the retort. The actions with assumed uniformity of size and

feeding will be discussed first and the effect of segregation will be taken up later.

As the coal rises in the retort toward the zone of combustion established by previous kinding of the fire, it is heated by conduction and radiation from the combustion zone. The coal rises in temperature and first gives off moisture and occluded gases, which are largely noncombustible. As it is further heated to 700° to 800° F., the coal particles become soft, the edges round off, and finally they become plastic. The degree of plasticity is governed by the origin of the coal, by the petrography of the individual particles, by the rate of heating, and by the extent of exposure to air during heating.

Coal Plasticity

Some coals become so plastic that they have the consistency of a frothy tar, whereas others soften only slightly. Therefore some coals so fuse together that the identities of the original particles are lost to the unaided eye, whereas others merely sinter together. The time during which the coal is plastic, and its degree of fluidity, determine the distance the material can flow under the pressure to which it is subjected. Therefore, for a given coal the sizes of the coal particles and of the voids determine the degree of cementation of the particles.

The plastic properties of coals have been investigated by a number of workers, among whom are Davis,[4] Gieseler,[5] and Layng and Hathorne.[6] They find that the temperature range during which coal is plastic is only about 150° F., after which the coke becomes hardened. Fig. 2 shows the plastic zone to start at about the level of the lower row of tuyeres in the stoker and to increase in thickness toward the center of the retort. It is thin near the tuyeres because of the oxidation by the air. It is thicker in the center because of the lesser penetration of air and the longer time for development of plasticity and cementation of particles. Fig. 3 shows that with the more strongly caking coal the plastic zone is somewhat higher in the retort and is considerably thicker than with the more freely burning coal of Fig. 2.

At the rear of the retort, where there is a greater percentage of fine coal, the voids are smaller and the particles fuse together more readily into a strong coke. At the front, where the coal is larger and the voids larger, not only does the size of the voids hinder the formation of strong coke but the air can penetrate more freely and lessen the development of the full plasticity. As previously mentioned, the rate of coal feed to the front half of the retort is frequently less than that to the rear. For this reason, also, the resistance of the fuel bed is less and, consequently, the rate of air delivery is greater at the front than at the rear. Some manufacturers of stokers compensate for this tendency by a decrease in the area of the tuyeres in the front part of the retort.

4. J. D. Davis: The Plastometer. a New Instrument for Measuring the Plastic Properties of Coal. *Ind. & Eng. Chem.*, Anal. Ed. (1931) 3, 43.
5. K. Gieseler: Measuring the Plastic Properties of Heated Coals. *Glückauf* (1934) 70, 178-183.
6. E. T. Layng and W. S. Hathorne: Determination of Temperature of Plasticity, Maximum Pressures, and Solidification of Coking Coals. *Ind. & Eng. Chem.* (1925) 17, 165-167.

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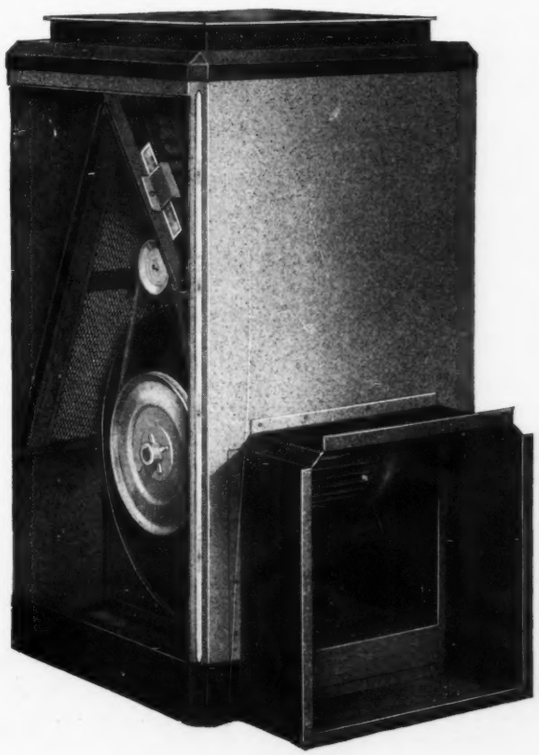

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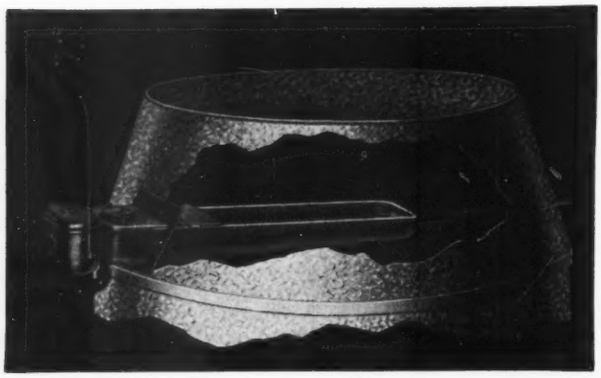

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Carbonization

Above the plastic zone, the distillation of the volatile matter continues and the coal becomes coke. The coke will not be of the same nature as that formed in the coke oven because in the stoker fire the coke is not restrained from expansion and is exposed to oxidation. However, even high-oxygen coals, which usually are considered noncoking or free-burning, form coke in the underfeed stoker. This is proof of the rapid rate of heating in the fuel bed, for it is only with rapid heating that such coals exhibit plasticity and coke formation.[7] The cokes vary in strength and porosity according to the characteristics and the sizes of the coals.

The coke mass continues to grow as more coal is pushed up from below and heat penetrates from the top and sides. The coke formation is variously called a coke "plug," "tree," "spire" or "spar." The difference in the type of formation with the two coals of different degrees of coking is shown in Figs. 2 and 3. The coke from the more strongly coking coal extended upward over 2 ft. and then broke off near the top. A number of cracks are visible where future fractures would occur. The coke trees always lean to one side, although conditions at the base or a force at the top may cause a shift in the inclination.

The coke from the more freely burning coal was open and poorly cemented, so that it extended only a short distance above the hearth. Pieces of coke fell from the tree at the slightest disturbance.

An increase in the air-coal ratio tends to decrease the size of the coke tree, especially the weight of coke on the hearth. Low heat-release rates, particularly hold-fire operation when coal is fed only for a few minutes at intervals of 30 min. to an hour, tend to increase the coke tree formation.

Low-volatile coals, such as Pocahontas No. 3, are strongly coking coals, although they are not used alone for cokemaking because of their swelling tendencies; they make coke trees, as would be expected. Pocahontas differs from high-volatile, strongly coking coals, however, in that the coke more readily breaks apart.

Combustion of the Coke

Figs. 2 and 3 have shown that in the center of the stoker retort there is a plastic zone surmounted by a column of coke, which are both quite impervious to air. Little opportunity exists, therefore, for combustion at the center of the retort. As previously mentioned, the first combustion is that of the combustible volatile gases evolved from the coal; then the air burns

7. G. B. Foxwell: Pressures Occurring in the Plastic Layer of Coking Coal during Carbonization. *Fuel in Science and Practice* (1932) 11, 370-377.

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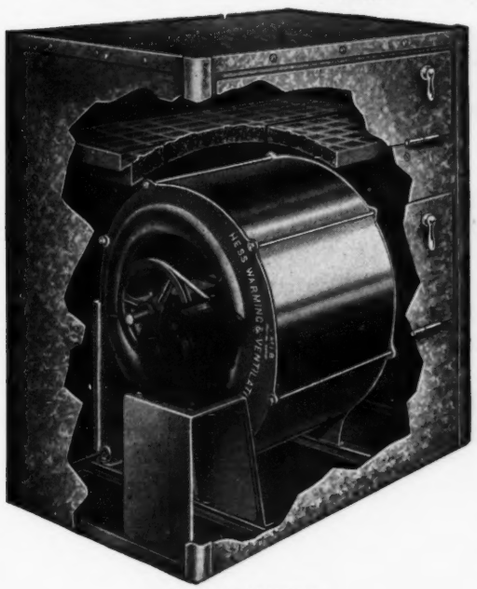

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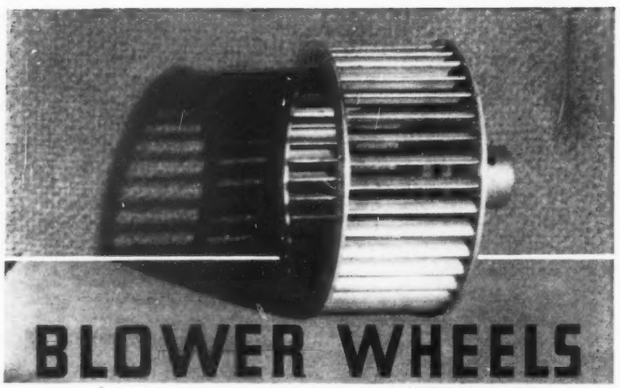

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the coke around the base of the coke tree and the pieces of coke that break off from the tree and fall into the air stream. With the more freely burning coals, as shown in Fig. 2, the coke formation is loose enough so that the air penetrates into the upper part of the tree and combustion occurs over a wider area, but with the strong coke formations the upper part cools, becomes black, and burns only after it falls back into the air stream.

Are Coke Trees Undesirable?

Those who have fired coal by hand in small furnaces have been accustomed to attempt to maintain a uniform, level, incandescent fuel bed. Furthermore, many of the pictures in the advertising literature of small stokers show a uniform, nicely rounded fuel bed, with rather distinct zones for the various reactions. When the user opens the door of his furnace for the first time after installation of a stoker and sees a ragged fuel bed with a spar of coke emerging from the center of the retort and leaning over toward one wall, he feels that the stoker or the coal is not acting as it should. He is likely to reach for the poker, break up the coke, and level off the fuel bed.

Our experience, and that of others,[8,9] indicates, however, that the undesirable features of coke-tree formations have been greatly exaggerated. Even with a strong degree of coking, if the combustion chamber is so designed that the coke when it breaks down by itself falls into the gas stream, where it can be burned, the coke formation does little harm.

A somewhat undesirable feature of such strongly coking coals is that so much more combustible material is in the furnace at any time that the removal of the clinker is more difficult than from the thinner fuel bed of a freely burning coal. Also, after removal of the clinker, the fuel bed is always broken up and compacted, so that for the first one or two operating periods thereafter the flue gases may contain a rather high percentage of carbon monoxide. In extreme cases, the plastic coal and coke may be so impenetrable and the coke so strong that only a weak ring of flame exists at the base of the coke column; then when the coke tree falls over it may carry the fire with it and the fire will go out. In other extreme cases of improper design of combustion chamber or improper installation of the stoker, the coke may fall out of the gas stream, so that it cannot be burned; it may even rise to stop the outlet of the combustion chamber, or it may push open the firing door.

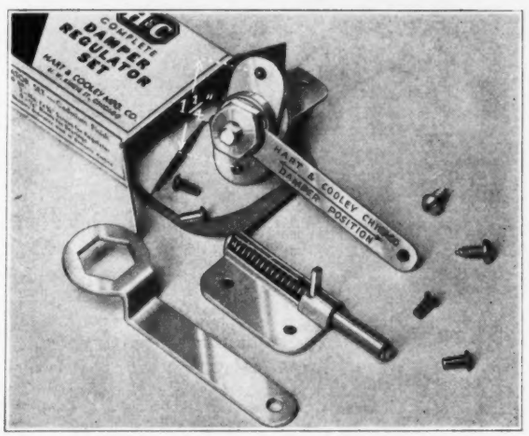
Caking Distinctions

No sharp line of demarcation exists in the caking and coking properties of coals, below which coals are suitable and above which they are unsuitable for present small stoker use. Furthermore, the coking properties of a coal in a stoker fuel bed may be modified, as was indicated in the discussion of the plastic state, by change in the size and the size distribution of the coal. The removal of fines from stoker coal is becoming increasingly common practice. The object of this practice is varied. With some coals, it may be to re-

8. Anonymous: Stoker Coals. *Bull.* of Chesapeake and Ohio Railway Co. (1935).

9. R. M. Pilcher: Use of Pocahontas Coal in Stokers. *Coal-Heat* (1936) 29, 38-41.

The New 1937 H&C *DAMPER REGULATOR SETS



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5. Handle at all times indicates position of damper.
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8. Bearings, handle, screws, and nuts are Cadmium-plated and bracket is die-cast, thus preventing rust.

All sets packed in attractive, convenient cartons, complete with all parts, as shown. Wrench for tightening nut furnished with each package of 12 No. 50¼ Sets and with each package of 6 No. 50⅜ Sets.

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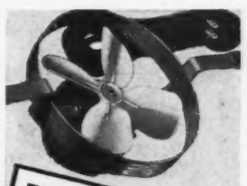

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duce the ash content, to render the coal less dusty, or to reduce the coke-tree formation.

Inasmuch as the removal of fines generally raises the problem of their economic disposal, and frequently results in a wastage of coal, the determination of when and to what extent it is desirable to remove the fines is one of the principal problems of the present research program. Briefly, our experience at this time shows:

1. With the relatively free-burning coals, although coke trees are formed, they are not troublesome and, from the standpoint of coke formation, no particular advantage results from the removal of fines.

2. With strongly coking, semibituminous coals, the coke formation is not greatly affected by the removal of the fines, partly perhaps because of the inherent coking characteristics of the coals but largely because, as a result of their friability, a large percentage of fines is found in the retort, although none is in the coal in the stoker hopper.

3. With high-volatile coals that coke enough to cause some of the difficulties described, the adjustment of the size range will generally reduce or eliminate the difficulties. The aim is to increase the size and percentage of voids in the coal in the retort as to decrease the strength of the coke. Therefore, the adjustment of the size range will normally be affected by the removal of fines, but it may also require a reduction in the top size. If the top size is too great, the crushing may produce too much fines in the retort. Whether the removal of fines should be at 48 or 10 mesh, at ¼ or ⅜ in., cannot be answered generally for all coals. Each coal is yet more or less an individual problem, although it is hoped that a more general solution will be found.

[To be continued]

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The conditioning system is installed on the gun deck with ducts leading to the berth deck below. The ducts extend from a spray chamber along the port side, above the guns, on brackets suspended from the deck above. A similar duct system extends along the port side of the berth deck, next below, connected with the main system by drops through the main and after hatches. This line has branches across to the starboard side and back to the officers' quarters in the stern. Similarly the gun deck line has branches across deck to starboard, with end grilles. Grilles are spaced about 25 ft. apart, eight on the gun deck and nine on the berth deck. Humidity is maintained at 30 to 35 per cent, with 70 F. dry bulb Unit heaters supplement this system at outdoor temperatures below 20 F.

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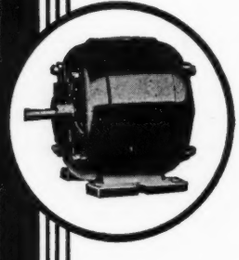

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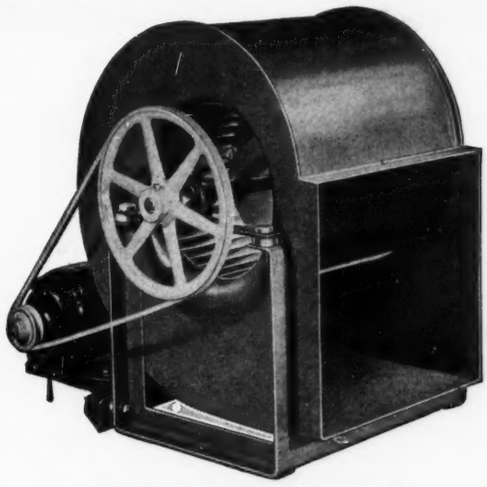

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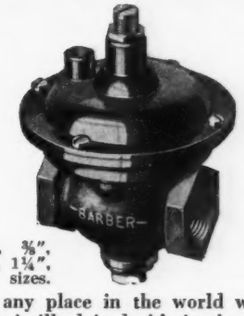

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Konzo-Design of F. A. Systems

(*Continued from page* 55)

cussion of this method of design is of interest in connection with a similar, but simpler, method which will be discussed next.

Procedure in Design for:

A. Velocity method
1. Individual duct system
b. Equal total pressures

1. This procedure is a modification of the method described as A-1-a and shows the calculations necessary to equalize the total pressure in each of the individual ducts to the same value as that for the duct having the greatest resistance. In other words, an attempt is made to equalize the total losses in each duct without the material assistance of dampers. It may be noted that the method is more complicated and the design velocities are not uniform in value. This procedure is also frequently used in other methods of design and hence should be given careful consideration. The procedure listed in items 1 and 2 in the method A-1-a will not be changed in this case. See columns (1), (2), and (3) in Tables 2a and 2b.

2. The duct having the greatest friction loss is selected. In this case duct *c* is the longest. The method of calculation shown in A-1-a is followed for the duct having the greatest resistance. See Table 2a. The values listed are the same as those listed in Table 1 and were derived in the same manner.

3. Assume that the actual friction loss for each duct will be the same as that for the longest duct. See column (10) in Table 2a. This is also shown in column (4) in Table 2b. That is, ducts *a*, *b*, and *d*, each of which carry different air volumes and are of different lengths, are assumed to have a total friction loss of 0.049 inch in this example.

4. The value of the friction loss for 100 feet of duct can be obtained as follows:

$$\text{Friction loss for 100 ft.} = \frac{\text{Total loss} \times 100}{\text{Length of duct in feet}}$$

For duct (a) the friction loss per 100 ft. is

$$\frac{0.049 \times 100}{20} = 0.245 \text{ in.}$$

5. From the known value for the air volume handled by each duct (column 2) and the value for the friction loss per 100 feet of duct (column 5), the required size of circular duct may be obtained from the friction chart. See column (6) in Table 2b.

From Fig. 2 the rectangular duct may be selected. In the example these values are listed in column (7) in Table 2b.

6. The duct area may be calculated as shown in columns (8) and (9) in Table 2b.

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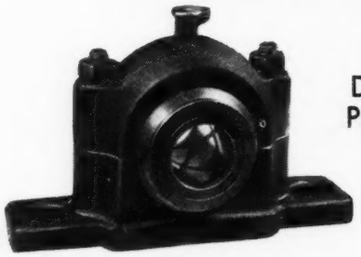

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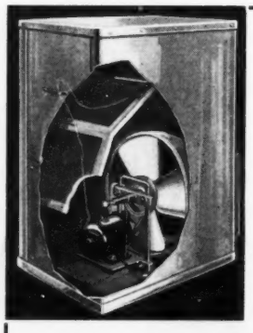

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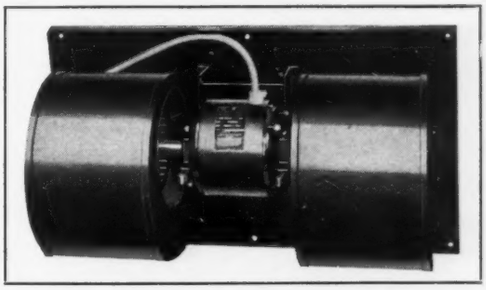

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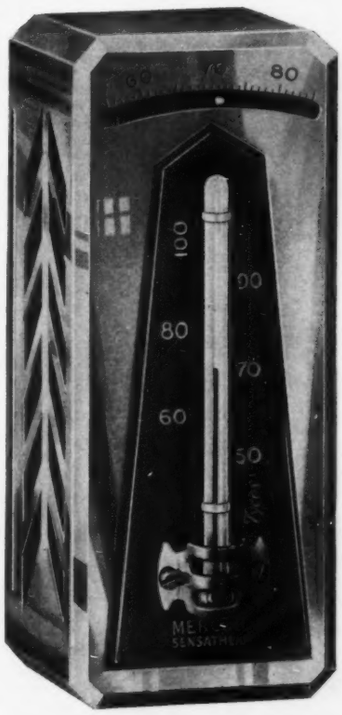

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7. The actual air velocity in the ducts can be obtained from the following equation:

$$\text{Duct air velocity, ft. per min.} = \frac{\text{Volume c.f.m.}}{\text{Duct area sq. ft.}}$$

Advantages of Method A-1-b

The advantages of this method of design may be itemized as follows:

1. See items 2, 4, 5, and 6 in the "advantages of method A-1-a."

2. The main difference between this method and the simpler method described as A-1-a is that the material for fabricating the ducts is used economically and less reliance is placed on dampers for balancing the distribution of air. A comparison of the duct sizes as calculated by the two methods shows the following differences:

	Method A-1-a		Method A-1-b	
Ducts	Depth	Width	Depth	Width
a	8	7.25	8	4.8
b	8	14.38	8	10.3
c	8	5.38	8	5.38
d	8	10.75	8	6.4

It may be noted that substantial differences were obtained in the sizes of the ducts required for ducts *a*, *b*, and *c*.

Disadvantages of Method A-1-b

The disadvantages of this method of design may be itemized as follows:

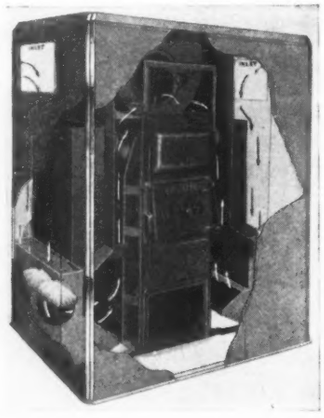
1. See items 2, 3, 4 in the "disadvantages of method A-1-a."

2. All of the ducts excepting the duct having the greatest frictional resistance are not designed for any definite maximum velocity. A comparison of the actual velocities in the ducts as determined for the two methods show the following differences:

Ducts	Method A-1-a	Method A-1-b
a	Less than 500	740
b	Less than 500	702
c	500	500
d	Less than 500	834

It may be noted that the maximum duct velocity is 500 ft. per minute for method A-1-a and is 834 ft. per minute for method A-1-b. In fact, the wide variations in the duct velocity obtained with the latter method hardly warrant the classification of this method in the section entitled "Equal Velocities." If the duct velocities in *a*, *c*, or *d* are higher than those desired, then the ducts should be enlarged in size.

The discussion of various methods of designing ducts will be continued in the next article, in which a modification of the method outlined in this article will be given. The method will be designated as A-1-c, or velocity method, individual duct system, standardized ducts. In many respects it is the method that deserves especial consideration in the prevailing tendency towards standardization.



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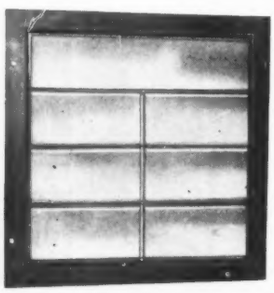

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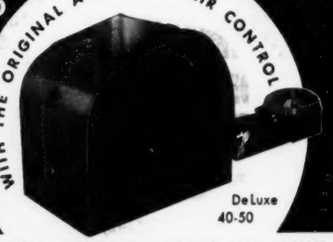

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Air Controlled WILL-BURT STOKER

THE WILL-BURT CO., ORRVILLE, OHIO
Automatic Coal Burner Division

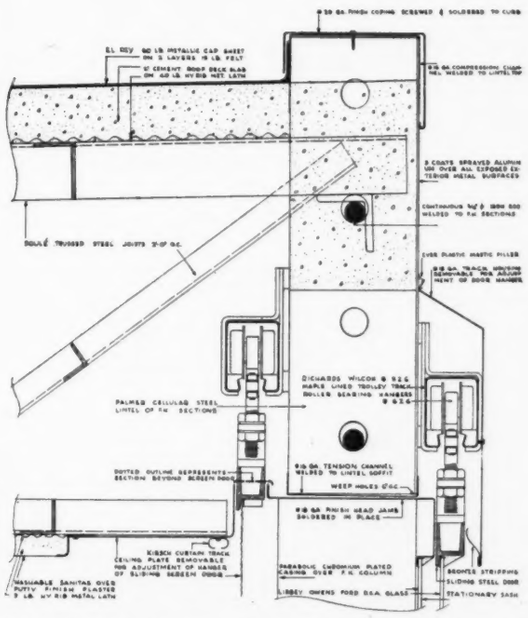
Floor Plenum Heating

(*Continued from page* 56)

weather, for once the floor radiating panel is thoroughly heated a low flame in the furnace will keep it that way.

For quicker heating in the morning or in mild weather there is an auxiliary heating system consisting of regular warm air ducts and registers. The heat is supplied by the same furnace units, however.

Another novel feature in this house is the method of reflecting the heat of the sun in summer. The metal exterior is painted with aluminum paint, while all fronts exposed to direct radiation from the sun have small intake openings at the foot of the cellular steel elements. Simultaneously with the warming up of the exterior surfaces by the sun these spaces initiate an automatic air convection which cools the wall and minimizes heat transmission to the interior caloriferic insulation board lining.



An idea of the ingenious construction of the house is indicated by this cross section showing the metal capping on outside walls, and bearings of the large sliding doors set in the walls.

Mr. Neutra finds a comparative analogy for his plan in the old Roman system of heating public bathing places. In those baths the floors were heated from a plenum chamber. This was done, however, by the burning of straw fed into the cavity by slaves, the flames contacting the radiating panels directly. In Mr. Neutra's plan the heated air is conveyed to the chamber by ducts, the panels not being contacted by the flames.

The house was among the first of cellular steel construction to be erected in the fashionable Pasadena area. In a nation-wide contest (Better Homes of America) this home design won first award and a gold medal. Two other houses by the same architect won honorable mention.

AUTOCRAT *Balanced Flame* OIL BURNERS

The Oil Burner That SELLS and STAYS SOLD!

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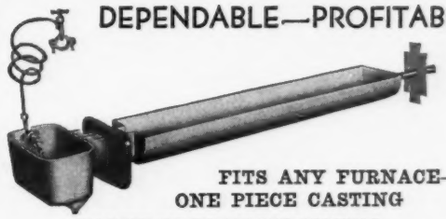

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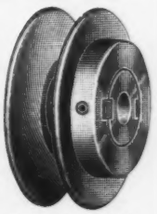

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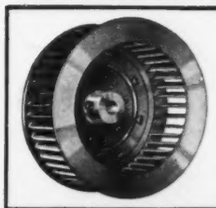

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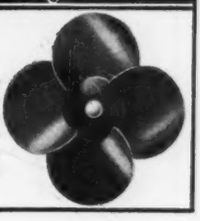

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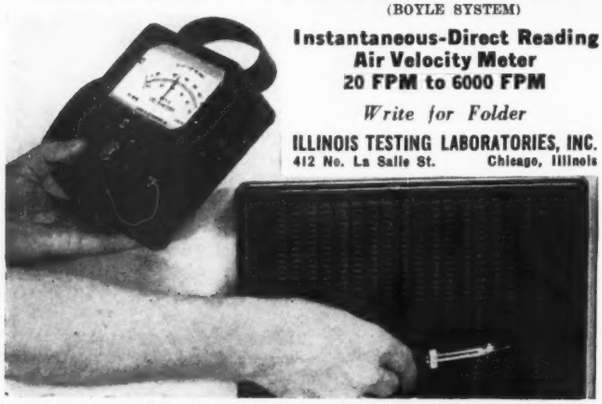

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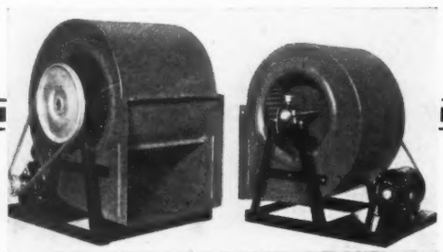

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CHICAGO STEEL FURNACE CO., write BLOWER DIVISION
7934 So. Chicago Ave. Chicago, Illinois

Explanation of Some Code Formulas

By William Scott
Bradfordwoods, Penna.

Infiltration Factor

ONE cubic foot of air at a temperature of 70 degrees weighs .075 lbs. To raise the temperature of one pound of air one degree requires .24 Btu.

To raise .075 lb., or one cubic foot one degree requires .24 × .075, which is .018 Btu.

Hence, .018 × 70, or 1.26 Btu. is the amount of heat needed to raise the temperature of the same cubic foot 70 degrees.

The number of thousands of Btu. to raise the temperature 70 degrees is $\frac{1.26}{1000}$, or $\frac{1}{800}$, nearly.

Therefore, the code division factor for infiltration is 800 for one change of air per hour.

Glass Factor

Allowing a little for safety, 1.2 Btu. is the heat loss through one square foot of glass for each degree difference of temperature, and 70 × 1.2, or 84 Btu., is the heat loss per hour through one square foot of glass, when the difference of temperature is 70 degrees.

Hence, $\frac{84}{1000}$, or $\frac{1}{12}$, nearly, is the number of thousands of Btu., and 12 is the division code factor.

Wall Factor

It has been found by experiment that the heat loss per hour for each degree difference of temperature, through a square foot of good frame wall, is .24 Btu. The loss for 70 degrees difference of temperature is 70 × .24, or 16.8 Btu.

Hence, $\frac{16.8}{1000}$, or $\frac{1}{60}$, nearly, is the thousands of Btu., and 60 is the division code factor for frame walls of good construction.

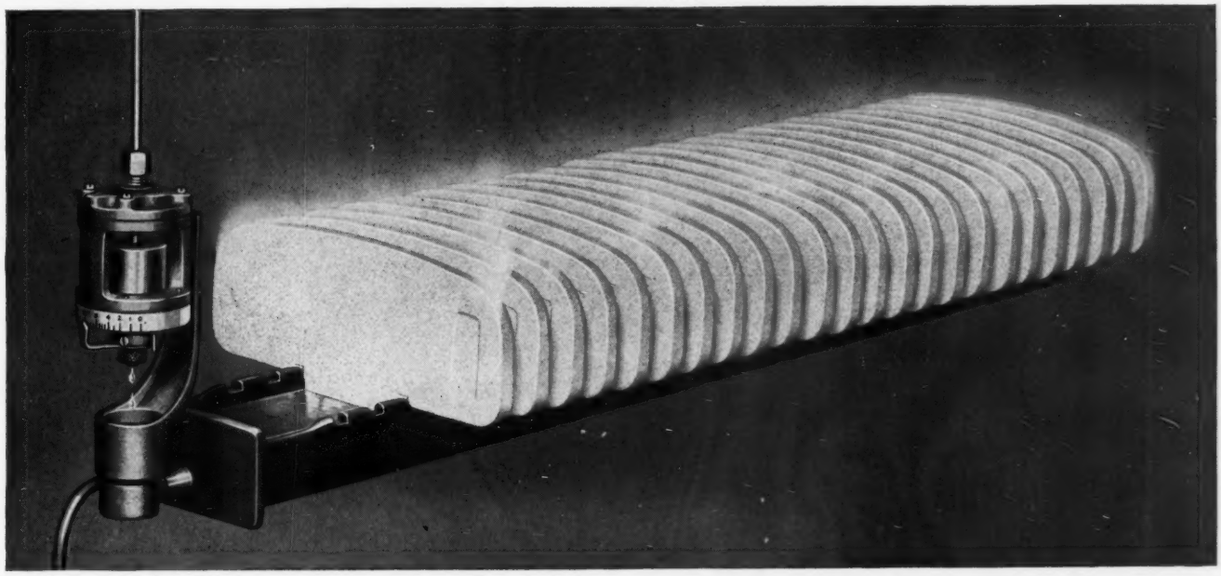
Other Code Factors

Other code factors for floors, ceilings, roofs and walls of every possible kind of structure and material can be got from tables, or calculated from the Btu coefficients by simply dividing 14.3 by the known coefficient. Thus, the coefficient for a plastered ceiling, including tight floor and roof above, is .16; and $\frac{14.3}{.16}$ is approximately 90, the code division factor.

Winter Time is Profit Time with

AUTOMATIC JUNE

HYDRO-METRIC HUMIDIFYING SYSTEMS



You can make money all winter long selling Automatic June. In cold weather home owners are actually experiencing the damaging effects of over-dry indoor air. The home is hot and stuffy and the whole family is subjected to winter colds and similar disorders. With Automatic June, room humidity is maintained at just the right percentage for comfort and health.

Humidity is graduated with relation to outside temperatures, with the result that even in the coldest weather, there will be no annoyance caused by frosted, weeping windows. And ample evaporation is supplied even at the low bonnet temperatures in mild weather.

You can tell your prospects—"No weeping windows . . . ample humidity at all times, even in mildest weather . . . nothing to look after . . . nothing to get out of order."

Automatic June comes in two types, "Room Controlled," and "Basement Controlled,"—illustrated above—fine in appearance and reasonably priced.

MONMOUTH PRODUCTS CO.
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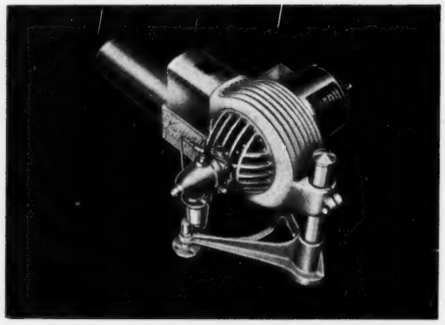
Presents

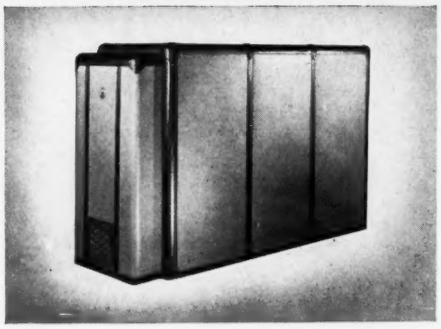
THESE UNEQUALLED FEATURES:

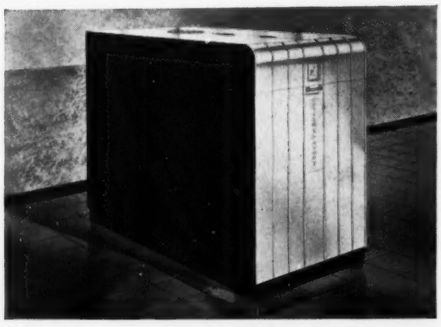
1. Automatic graduation of humidity—always maintaining the maximum room humidity that health demands and prevailing outdoor temperature permits—eliminating excess indoor condensation even in the coldest weather.
2. Evaporating capacity adequate even under the low bonnet temperatures of blower-equipped, thermo-controlled furnaces in mild weather.
3. Cannot lime or clog.
4. Visible drip feed with indicated rate in gallons per day.
5. Easy to install. Evaporators to fit smallest to largest furnaces.
6. Reasonably priced — impressive — sells almost on sight. One installation sells another.
7. Being adopted by leading furnace manufacturers.

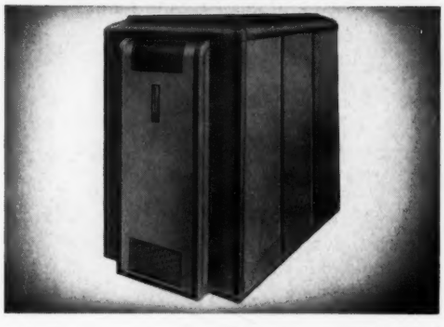
Send for Free Book — "The Science of Re-Humidifying Indoor Air," together with literature describing Automatic June Humidifying Systems.

Step up your Automatic Heat Business









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Rock Island, Illinois

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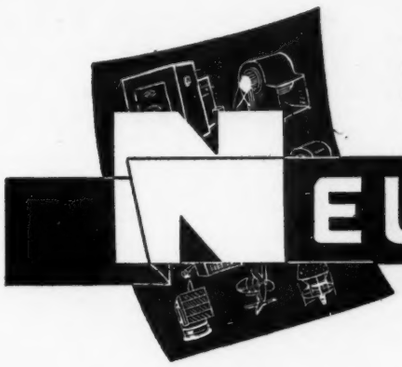


For your convenience a number has been assigned each item. Check the items in which you are interested on the coupon on page 97 and mail to us. Complete information will be forwarded.

● **Indicates product not listed in 1936 Directory**

△ **Indicates product and manufacturer not listed in 1936 Directory**

NEW PRODUCTS

148—G-E Gas-Fired Conditioner

General Electric Company, Bloomfield, New Jersey, announces a warm air conditioner, gas fired. This is a di-

rect fired air conditioner developed especially for residential winter service; and cooling coils for complete summer air conditioning may be added at a later date.

The one-piece cast iron heating unit eliminates possibility of flue gas leaks, and electric pilot switches prevent openng of the main gas valve until all pilots are burning. Fully automatic humidity control and thermostat enable the mechanism to function steadily without attention. Inclusion of the aphonic radial flow fan secures delivery of more air, against higher pressure but with less noise. The heating surfaces include radiation screens of sheet steel, of ample surface and with high heat transfer rate.

◆

149—Armco Galvanized Paintgrip Sheets

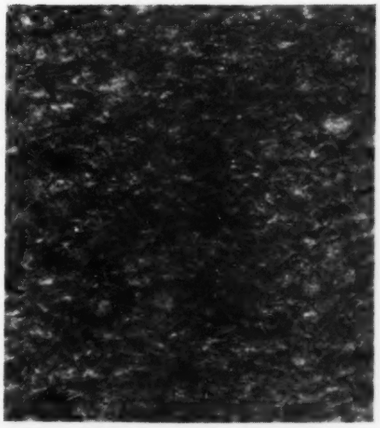
The American Rolling Mill Company, of Middletown, Ohio, announces full commercial production of a new kind of galvanized sheet that assures a good paint bond on iron and steel products.

Introduction of Armco Galvanized Paintgrip sheets follows several years of intensive research on the part of Armco's metallurgists and the technicians of the Parker Rust-Proof Company. This new kind of galvanized sheet metal can be painted without special treatment of the surface by the user.

Armco Paintgrip sheets, the manufacturers say, are chemically treated to produce a finely crystalline phosphate coating which in itself is neutral to paint (being neither acid nor alkaline) and keeps the paint from direct contact with the zinc surface. This coating is an integral part of the sheet and is slightly granular in nature.

Armco Paintgrip Sheets are available in any of the grades of galvanized sheets manufactured by the company. Analysis of the base metal can be that of Armco Ingot Iron, plain or copper-bearing steel. When it is required, all grades of these sheets can be supplied stretcher leveled.

Forming qualities of Armco Paintgrip sheets are the same as untreated galvanized sheets. They may be soldered satisfactorily with the use of hydrochloric acid as a flux.



While Paintgrip sheets shipped from the company's mills are prepared to receive paint without further treatment, handling and fabricating operations in customers' plants will often necessitate cleaning. Organic cleaners such as naphtha, benzine and lacquer thinners are preferred.

If alkaline cleaners are used, the Paintgrip surface will be attacked and partly removed by their action.

Practically any good paint can be applied to Armco Paintgrip sheets. If baked finishes are used, the paint manufacturer usually recommends a suitable primer. Any good baking system will be found satisfactory provided the baking temperature does not exceed 450 degrees F.

Formation of a Paintgrip coating on metal is dependent upon the fact that phosphoric acid solutions will dissolve zinc phosphate within certain definite limits. Passing zinc coated iron or steel products through such a solution results in the formation of the Paintgrip coating which becomes an integral part of the metal surface at the point of solution. Reaction takes place with the evolution of hydrogen, continuing until the metal surface is converted to a crystalline phosphate coating.

◆

150—Anemometers

Julien P. Friez & Sons, Inc., Baltimore, Maryland, announce a new range of anemometers designed especially for indoor application.

The present design represents twenty-three years' experience in the building of anemometers of this type, and each instrument is said to receive the individual attention of skilled craftsmen. These are available for practically all types of applications, ranging from extremely low speeds up to hurricane velocities. The type illustrated covers accurately the velocity range of from 75 to 3000 feet per minute. Carrying cases are available for the protection of these instruments when not in use.

In addition to the Biram type illustrated, which gives readings directly in linear feet, direct readings are also

available which give readings directly in feet per minute.

Bulletin I fully describes the standard types of Friez Anemometers. Copies are available.

New Products . . . . . .

For your convenience in obtaining information regarding these items, use the coupon on page 97

151—Electrode Welding Chromium

The Lincoln Electric Company, Cleveland, Ohio, announces a new electrode which they say will successfully weld steels known as 4-6 per cent Chromium steels used in applications requiring resistance to crude oil corrosion at high temperatures and pressures.

The electrode contains the essential element of molybdenum and provides weld metal possessing the necessary high creep strength and other qualities essential for welding the 4-6 per cent chromium steels. Such steels, welded with the electrode can be soft annealed to physical properties similar to those of mild carbon steel, and therefore rendered suitable for equipment where severe cold working is applied during fabrication.

"Chromeweld 4-6" deposits, produced with proper welding procedure and fully annealed at 1550-1600 deg. F., followed by slow cooling in the annealing furnace, or air cooled from 1200 deg., possess approximately the following characteristics: Tensile strength 65,000 to 70,000 lbs. per sq. in.; yield point 35,000 to 40,000 lbs. per sq. in.; ductility of 35 to 40 per cent elongation in 2 in.; reduction in area 65 to 75 per cent; hardness (Brinell) 130 to 140. If stress relieved at 1400 deg. F., the physical properties of the "Chromeweld 4-6" deposit are approximately as follows: Tensile strength 80,000 to 90,000 lbs. per sq. in.; yield point 55,000 to 65,000 lbs. per sq. in.; ductility of 24 to 30 per cent elongation in 2 in.; reduction in area 60 to 70 per cent; and hardness (Brinell) 155 to 175.

◆

152—Armstrong D-I Corkboard

Armstrong Cork Products Company of Lancaster, Pennsylvania, has developed a new type of corkboard insulation for ducts, to meet the requirements of small commercial air conditioning installations, according to an announcement by T. R. Numan, manager of the Low Temperature Insulation Department of the company. The new product will be known as Armstrong's DI (Duct Insulation) Corkboard.

The main problem in such installations, according to Mr. Numan, is to prevent condensation rather than to conserve refrigeration, hence the new type of corkboard, offered in ½-inch thickness, is sufficient.

Armstrong's new DI Corkboard is not affected by moisture, and the producers claim a thin mastic coating on one side strengthens the material, increases its flexibility, seals it against moisture penetration, and provides a finish.

DI Corkboard can be erected readily in waterproof cement or asphalt and, because of its light weight, reinforcement with wires or bands is not necessary in many cases. It can be made to conform to sharp curvatures and can be cut and fitted with a sharp knife. The thermal conductivity value of DI Corkboard is claimed to be exceptionally high due to its special light density. It is available only in ½-inch thickness in 12x36 inch sheets.

◆

153—New Notcher

The Whitney Metal Tool Company, Rockford, Illinois, has developed a new and improved notcher tool for cutting out beaded corners, the edges of curved seams, and the like.

The Whitney "Notcher" has two features. The first is the construction of the die, which is made of two pieces

of hardened tool steel and has full clearance so that the punchings can drop through. The second is the double-duty depth gauge mounted on the right side of the die. This gauge has two lugs on opposite sides and is reversible so that any depth of notch can be set without the gauge projecting beyond the end of the die. The gauge is locked in position by a screw. The hardened tool steel punch is screwed to the upper jaw.

Handles are steel forgings, finished in "machine tool grey" lacquer with polished handles of comfortable design. A strong return spring between the handles is mounted on a pin. All parts are carefully machined.

154—Armco Stabilized Steel

The American Rolling Mill Company, of Middletown, Ohio, announces full commercial production of "Armco Stabilized Steel" in cold rolled sheets and strip.

Stabilized steel is offered by the company as a uniform, extra deep-drawing and non-aging cold rolled steel with all stretcher strain permanently eliminated in the tempered condition. It retains indefinitely all of the properties of temper-rolled steel, making pre-fabrication treatments unnecessary, regardless of the length of time the metal has been in stock.

This new steel is said to be free from blue brittleness, indicated by the fact that the tensile strength does not increase in the blue brittle range as is the case with mild steel.

An important property in deep drawing sheet material is uniform ductility. Stabilized steel possesses the further advantage over ordinary mild steel in that the amounts of temper rolling commonly used for tempering the sheets do not impair the ductility. This advantage is most important in case of very severe drawing requirements which ordinarily demand a very close adjustment of the amount of temper rolling to prevent breakage and stretcher straining.

◆

155—The Synhibit Process

Thompson & Company, P. O. Box 6757, Pittsburgh, Pa., maker of industrial and technical paints, has invented the Synhibit process for preserving structural steel, said to provide a rust free surface to which more efficient, longer-lived, better adhering protective coatings may be applied. This new method consists of a scientific, chemical, and metallurgical pre-treatment of the metal surface.

Any loose rust or loose scale on the surface is removed by wire brushing. That portion of the scale which is tight and remains, is a protection to the metal surfaces and aids in the retention of the paint. This wire brushing is followed by a treatment of the wire brushed surfaces with Synhibit Inhibitor which dissolves and kills the remaining rust and prevents it from forming again. It not only kills surface rust, but penetrates into the minute cracks in the scale and kills embedded rust so completely that it can never grow under the surface of the scale or the protective covering.

In addition, the inhibitor forms an ideal surface for the retention of the Synhibit synthetic paints, and also insulates and prevents the formation of galvanic electric currents which would start corrosion and destroy the paint film.

The Inhibitor treatment is followed by the application of Synhibit Primer, a Zinc Chromate, Iron Oxide Synthetic Vehicle paint. Synhibit Aluminum finish coat is recommended in most cases for the final coating.

New Products . . . . . .

For your convenience in obtaining information regarding these new items, use the coupon on page 97

156—New Lead Head Nail

W. H. Maze Company of Peru, Illinois, is introducing the new Anchor lead headed nail, said not to draw out or work loose. To gain holding power, this nail employs the well

known principle of an anchor, the anchors being arranged in rings about the shank as illustrated. The manufacturers point out that this principle, on a lead headed nail, is superior to a screw because it does not twist the head loose and cannot twist out backwards.

◆

157—The Punkah Louvre

Kelvin & Wilfrid O. White Co., 90 State St., Boston, Mass., are American representatives of Thermotank Limited, Govan, Glasgow, S. W. 1, Scotland, introducing the Thermotank Punkah Louvre System.

The Punkah Louvre is said to be a complete departure from all former types of air inlets in that it incorporates the principle of "high velocity delivery" of the ventilating air, involving speeds of 30 to 50 feet per second, while the directional properties of the louvre enable this to be accomplished without any draft. The advantage of this type of delivery is that the delivered air is completely mixed with the atmosphere of the space ventilated, and a stagnant condition is impossible. The cooling power of ventilating air depends on its temperature, humidity, and motion, and is increased by low temperature, low humidity, and high velocity of motion. Unless the cooling is carried to an extreme degree, it has a beneficial effect on the health and comfort generally, so that a comparatively small amount of air brought into a space at high velocity is an ideal method of ventilation when complete control of the direction of this air is available, in order to occasion no inconvenience.

There are three types of the Punkah louvre—A, B and C—differing only in their method of controlling and shutting off the supply of air; and each has special features—the conditions and type of installation governing the choice. The louvres are made in various sizes, covering a range of outputs.

Where louvres are designed to give service for both warm and cold climatic conditions; diffusors are available which are capable of converting the concentrated high velocity jet into a diffused, but solid air cone, wherein the velocity does not exceed one-tenth of that created by the uninterrupted jet.

The distributer is intended primarily for the ceilings of large public rooms, but its properties make it an excellent inlet for delivering air through walls also. The fitting consists of a specially shaped dome with a movable deflector plate opposite the air inlet, which may be adjusted to distribute the air radially along the ceiling or to direct the air downwards.

◆

158—New Timken Burner

Timken Silent Automatic Division of the Timken-Detroit Axle Company, 100 Park Avenue, Detroit, announces the introduction of a new and larger Timken Silent Automatic pressure burner.

The new model, known as the Model GH, is designed along conventional lines. It has an oil burning capacity of from 5.50 to 10 gallons per hour and is capable of handling approximately 3,600 square feet of equivalent direct steam radiation. The burner consists of a one-sixth h. p. split-phase motor, directly connected to the blower and oil pump by a flexible coupling. The oil pump is equipped with dual strainers and the transformer with an interference eliminator. Combustion efficiency is improved by a propellor-like, four-bladed turbulator located in the air tube just back of the oil nozzle.

Minneapolis-Honeywell controls are standard equipment on the burner.

159—Tanco Sound Deadener

Thompson & Company, P. O. Box 6757, Pittsburgh, Pa., makers of industrial and technical paints, is offering Tanco sound deadener for air conditioning ducts. Features claimed are that Tanco dries over night to a smooth surface which does not increase air friction or collect dirt, strong adhesion (does not crack off or rub off), has good heat insulating qualities, and may be applied with a brush or a spray. The color is a pleasing light gray which may be applied on the outside of ducts for a finish coat.

◆

160—Portable Combination Brake

Whitney Metal Tool Co. of Rockford, Illinois, introduced their "Air Conditioning Special," a portable bending brake weighing 265 pounds and having a capacity of 49 in. in 20-gauge metal, last spring. They have added to their line a new model of this same machine, having the same capacity and embodying the same features, but with the addition of fingers for box and pan bending, thus providing sheet metal workers with a portable combination brake which can be easily carried out on the job. This machine is said to add materially to the speed of fabrication of ducts and other sheet metal work used in air conditioning systems, warm air heating installations, and the like.

The construction of the "Air Conditioning Combination Special" is much the same as the plain bending model, except for changes in the arms supporting the upper jaw. These arms now have two alternative fulcrum points, so that the jaw can be raised and shifted back to accommodate the box fingers which are attached to the front edge. Set screws on the support members can be adjusted for the

gauge of metal being used. There are also two alternative connections for the adjustable toggle links which actuate the upper jaw, and two sets of return springs, one for plain bending and the other for box bending. These springs lift the upper jaw out of the way automatically when the bend is completed. The machine is made for bench or floor mounting, the lower part of the angle iron support frame being unbolted for bench mounting. Box and pan fingers of various widths are furnished.

New Products . . . . . .

161—Pen-A-Trate Joint Breaker

Grapho Products, Inc., 2232 Alvord Street, Indianapolis, Indiana, has developed a product that they claim will break the most obstinate and corroded joints almost instantly.

Pen-A-Trate is a fluid which filters quickly into the threads of joints to be broken. Upon coming in contact with the corrosion Pen-A-Trate forms a gas which dissolves the rust into a fine powder and permits the joints to be broken easily.

It is intended for use on joints, bolts, studs, etc., where corrosion has made removal impossible without breaking. If applied thoroughly they say Pen-A-Trate will loosen these unyielding joints in two or three minutes. Only a tap with a hammer and the joint can easily be removed.

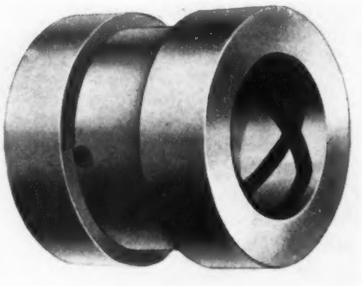
Pen-A-Trate is also said to make an ideal spring spray when mixed 5 per cent with crank case drainings.

◆

162—Reservoir Graphite Bushings

Randall Graphite Products Corporation, 609-613 W. Lake Street, Chicago, has developed four types of oil reservoir graphite bronze bushings for installations requiring a predetermined lubrication life or centralized lubrication control. The bushings supply automatic lubrication control by feeding lubricant from the reservoir through graphite plugs which regulate the rate of flow. Additional positive lubrication is supplied in machined grooves on the bearing surfaces.

Two of the bushings provide their own reservoir space by undercuts on the outside walls. Of these, one is designed for high speed installations



or for intermittent use where lubrication is supplied only during assembly of the product or at long intervals. The other is designed for installations such as automotive water pumps and has lubrication for both bore and flange supplied through graphite feed plugs and graphite-filled grooves.

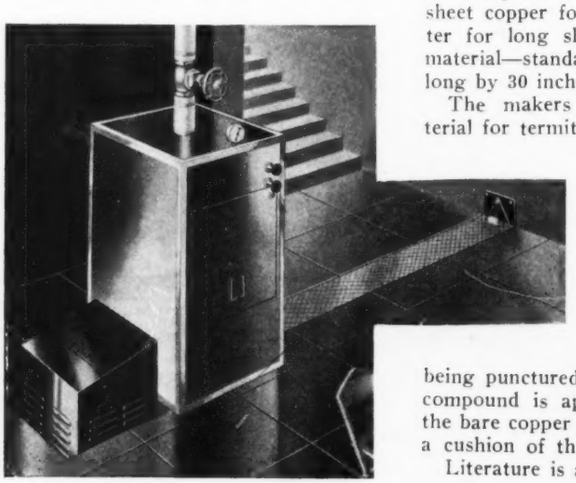
The other two bushings are designed for applications where the oil reservoir is provided in the bearing housing. These bushings are also lubricated through graphite plugs and grooves. One is equipped for lubricating both the bore and the face of the flange.

◆

163—Anchor Bin Feed Kolstoker

Anchor Stove and Range Company, New Albany, Indiana, announce the Anchor Bin Feed Kolstoker—feeding the coal automatically from the coal bin to the burner in the furnace.

The Anchor Bin Feed Kolstoker is furnished in either the Draw Conveyor or the Drive Conveyor type. In the Draw Conveyor type, the screw conveyor draws the coal from the bin and conveys it under the floor through the feed tube to the burner. A reverse screw arrests the movement of the coal toward the stoker power unit and forces it up through the burner to the fire. In the Drive Conveyor type, the power unit of the stoker drives or pushes the coal from the bin toward the boiler, instead of drawing it from the bin as in the Draw Conveyor type. The stoker power unit is located behind the bin. The bin itself functions as a gigantic hopper.



◆

164—Ward Flanging Machine

The Ward Machinery Co., 564 W. Washington Blvd., Chicago, announces a new flanging machine designed for ventilating and air conditioning work on 22-gauge metal and lighter in the average shop. It will flange a minimum radius of 3 in. on fittings and any inside or outside curved work.

The first operation is starting the edge, using the turning rolls. The second operation completes a 90 deg. flange. The machine is adjusted on the lower shaft to accommodate the

gauge of material being used. For the second operation, special hardened rolls have been designed so that the slant or taper compensates for the spring-back in the material. The height of the flange is dependent on the thickness of metal and size of the radius.

Mounted on a bench and hand operated, the machine is sold complete with both rolls, stand and wrench. Weight 40 lb.

◆

165—Rubberseal Copper

Mitchell-Rand Company, 51 Murray St., New York City announces "Rubberseal Copper." Sandwiched between two layers of a mineral rubber, (permanently elastic asphalt), the Electrosheet copper forms a solid metal center for long sheets of the combined material—standard rolls being 24 feet long by 30 inches wide.

The makers recommend this material for termite proofing, weather resistance and sealing in of structures intended to be air conditioned.

The "Rubberseal" compound is said to remain flexible under all temperature conditions and to self-weld or "heal" upon being punctured. About $\frac{1}{16}$ in. of the compound is applied to each side of the bare copper sheeting, so as to form a cushion of the mineral rubber.

Literature is available.

New Products . . . . . .

For your convenience in obtaining information regarding these items, use the coupon on page 97

166—Airobot

The Best Airobot Company, of Hamilton, Canada, and Niagara Falls, New York, has patented the Airobot.

The motor fan is controlled by a thermostat. As soon as the contact is established to start the fan in operation, the drafts are changed automatically. The air current set up by the fan strikes the balanced shutter directly in line with the duct connected to the furnace heating jacket. This forces the shutter down but does not cut off the air flow through the duct because there is ample room above it. However, attached to the same axle as this shutter (and controlled by it) are two others that work in conjunction with it. A sliding door in the casing of the compartment controls the amount of air taken in and passed through the fire pit. When the fire has burned up to the desired heat the automatic circulating fan automatically shuts off, but convection currents (gravity flow) continues as the control shutter occupies only a very small portion of the duct from the blower. The central control shutter is weighted to swing back into place. This automatically closes the combustion draft and opens the check draft.

The Airobot contains air filters made of fine steel or glass wool.

The humidifier consists of a fine jet of water directed against a baffle and is designed to atomize the water effectively. It is set to provide approximately 30 per cent humidity and is adjustable.

The motor is rubber mounted and the motor fan is cork insulated.

◆

167—Miles Junior Air Conditioner

The Henry Furnace & Foundry Co., 3471 East 49th Street, Cleveland, Ohio, announces the new improved Miles Junior Air Conditioner, designed for the home owner of average means.

This conditioner was especially designed for use in a gravity warm air heating job and is said to operate quietly. The automatic louvre, opening when the fan stops, supplies ample air to the furnace for gravity circulation, the air passing through the filters all the time. When the fan starts, the louvre closes.

Four filters provide plus air-cleaning capacity. A three-speed motor gives the home owner a wide latitude in air circulating capacity. A large door at rear of box makes easy access to the interior. The Miles Junior is compact and finished in a crackle green. It is readily inserted in place of the cold air boot of any furnace. It may be used with cold air returns connected to the top of cabinet or may take air from the basement.

◆

168—New "Clip" Punch

The Whitney Metal Tool Co., Rockford, Ill., announces a new tool for use by sheet metal workers in assembling duct work for air conditioning installations, warm air heating systems, etc. It punches out a triangular "ear" in the seam, this ear then being folded back by hand to form a secure fastening with a three-

way lock. The punch has a capacity of two thicknesses of 16 ga. metal, enabling it to be used on even the largest of ordinary ducts.

The jaws and handles are of drop forged steel, carefully finished, with hardened pins and careful machining and assembly. Punches and dies are securely mounted, but easily removable, and are designed to make the correct form of clip and bend it down for easy folding. The jaws have a special flat alligator-like nose, enabling the punch to be used in narrow places and under the edges of folded seams.

◆

169—Little Giant Tork Clock

The Tork Clock Co., Mount Vernon, New York, announces the new Little Giant Tork Clock for the daily automatic control of electrical circuits. The clock operates without winding or regulating and may be quickly set on variable schedules without the use of tools. The twenty-four hour day is divided into four sections of six hours each covering morning, afternoon, evening and night.

The device is made of non-corrosive materials, including heavy clock brass, stainless steel, and moulded bakelite. A non-magnetic housing prevents distortion of the strong magnetic currents which drive the motor. Fast moving gears run in a sealed oil chamber. Rifled bearings and a new centrifugal thrower prevent oil leakage or evaporation. A counter-clockwise second hand indicates proper motor operation. The device has 5,000 watts capacity for either single or double pole service and is housed in a cadmium-plated case with unbreakable window. A large wireway and five plug buttons for ½ and ¾-in. conduit connections facilitate installation.

◆

170—Nozzle-Type Registers and Grilles

The Waterloo Register Company, Waterloo, Iowa, is offering the Air-Master (Nozzle-type) registers and grilles for quiet, efficient jet control of forced air.

These grilles, they say, act upon the air flow through an orifice similar to the manner in which spray nozzles control the flow of liquids. Paths of air may be converged to provide the type of distribution required, whether it is sudden or rapid diffusion or long distance ejection. This enables the engineer to mix the incoming air with room air, according to the best suited way for prevailing conditions. Many varied jet openings are available. The rigid exterior bars are placed horizontally and provide vertical control. They also form a solid protective grille front for the interior adjustable bars, and their ¼-inch spacing makes a close screening to prevent the admission of small foreign particles. The grilles may be installed without fear or damage from meddling. As the exterior bars which form the grille surface are fixed on a plane 3/16 in. ahead or above the plane of the interior bars, they are accessible to cleaning, and a few crosswise strokes with brush or cloth quickly accomplishes this purpose. The adjustable interior bars are placed vertically and provide lateral control. Free areas, allowing for border deductions, are not under 70 per cent in the smallest size (10x4) and in many cases, particularly in styles 2P, 3P and 4P, are more than 80 per cent. Six styles of grille formation are supplied with any of the jet openings, the difference in each style occurring only in the type and arrangement of the interior bars, spacings, and design.

Catalog No. 16 gives specifications for the six types.

◆

171—Oil A. C. Unit

Gar Wood Industries, Inc., Detroit, Michigan, is now manufacturing a new, automatic oil heating and air conditioning unit — 102-A — designed for the average home.

The new, Gar Wood Tempered-Aire model 102-A provides humidifying, air filtering and forced warm air circulation in addition to automatic heating in the winter and blower cooling and air filtering in the summer. In the new 102A unit the oil burner is not enclosed, otherwise the unit resembles previous models.

New Products . . . . . .

For your convenience in obtaining information regarding these items, use the coupon on page 97

172—New Design G-E Motors

General Electric Company, Schenectady, N. Y., has recently placed on the market a new design of riveted-frame squirrel-cage polyphase, induction motor, in frame sizes of from one to 15-h. p. at 1,800 rpm. These new motors incorporate improvements in stator-coil insulation, frame construction and other design features, and are available in a variety of electrical and mechanical modifications.

A new insulation system is employed for the stator-coil windings, which are of the random-wound type, with joints at the connections fused instead of soldered. Recently developed insulating materials and processes are utilized, eliminating the need for taping the end windings and producing an insulation assembly with high resistance to moisture and other common deleterious influences such as mild acids, alkalis, oil, and abrasion.

◆

173—Giant Grip Jr. Welder

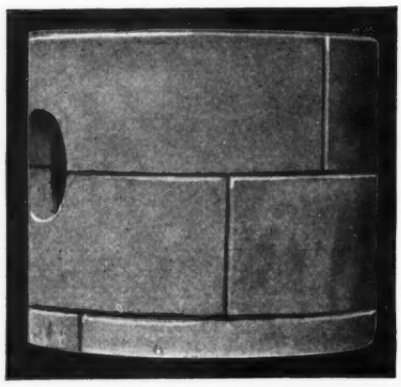
Giant Grip Mfg. Co., Oshkosh, Wisconsin, announces a new welder, known as "Giant Grip Junior," in four models from 90 amperes to 300 amperes capacity.

The new welders are lighter in weight than the standard welders due to the wood construction of the cabinets and the arrangement of the amperage control, there being only ten controls in two models and 16 controls

in the other two, while the standard welders have 27 and 36 controls. These new welders are specially designed transformer type, but without reactance control, static high frequency arc or sheet metal attachment. Each is equipped with rotating knife switch control with amperage distinctly marked indicating each step in welding. They are not auto transformer type welders and can be used on grounded systems and for water pipe thawing.

174—Roto Combustion Chambers

The Rex Clay Products Co., 14402 Dexter Blvd., Detroit, Michigan, is ready for distribution of their new combustion chamber for gun-type oil burners. This chamber is said to have had real field tests by competent engineers. The Roto combustion chamber is made of refractory insulating materials and, they say, arrives at a high surface temperature almost immediately, resulting in maximum efficiency of burner operation.



Complete combustion in an intermittently fired job brings the oil burner overall efficiency high by causing immediate combustion and high CO_2 readings without having to run for some time to reach these high readings.

The Roto combustion chamber comes ready to install with no cementing necessary. It fits all gun-type burners and can be easily and quickly installed in any furnace.

◆

175—Airtemp All-in-One Conditioner

Airtemp, Inc., New York City, announces a new type all-in-one air conditioning unit, incorporating new principles of design, for shops, stores and offices.

The new 3-h.p. capacity unit, including compressor, motor, condenser and cooling coils, is contained in a cabinet using 20 by 33 inches of floor space. Its compactness is due to a new reciprocating type radial compressor, so designed that it can be encased in the base of the cabinet, suspended on rubber mountings. It is unusually quiet and vibrationless.

The new unit provides for overhead distribution of conditioned air. It is seven feet, six inches in height, with a diffusion type grill near the top, and provides for the circulation of 1,200 cubic feet of air per minute.

An important feature of the unit is its semi-portability, permitting the merchant or shop owner to take the unit with him from one building to another, the same as any other fixture. Only simple electrical and water connections are required.

If desired, the unit can be adapted to a duct installation to care for the conditioning of several individual rooms. There is also provision for bringing in outside air for ventilating purposes. The unit can also be used in a battery.

◆

176—Power Squaring Shears

The Niagara Machine and Tool Works, 637 Northland Ave., Buffalo, N. Y., announces an entirely new series HL Power Squaring Shears designed for high production, accurate flat strip cutting, yet employing all the features of a general purpose squaring shear.

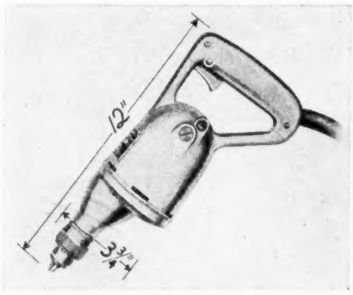
The Niagara patented box section steel holddown is toggle operated and has independent feet exerting increased pressure very close to the knife edge, thus facilitating accurate cutting of flat narrow strips.

The main members of the machine are so placed that there is unobstructed vision from the front of the machine to the back, thus minimizing the danger of the operator engaging the clutch while a second operator or helper is in a dangerous position at the rear of the machine.

◆

177—Portable Electric Drill

Signal Electric Mfg. Co., Menominee, Michigan, announces a new light duty ¼-in. portable electric drill, designed for intermittent service. Designated OB-8, they say it is properly balanced, with an air-cooled handle having a comfortable grip; trigger type switch in the handle with lock for continuous operation. It is powered by a Signal Universal motor for DC or AC 110-120 volts, 25-60 cycles, and is low in price. It is 12 in. long and 3¾ in. wide. The shipping



weight is 7 lbs. Equipped with 8 feet of heavy-duty, rubber-covered cord with rubber cord protector and a rubber plug; Almond 3-jaw chuck with key. The housing is durable aluminum alloy; bronze bearings, wool packed, with thrust ball bearing on spindle shaft. The gears are special alloy heat treated. Brushes are accessible from the outside. The speed at no load 2950 R.P.M.

New Literature . . . .

For your convenience in obtaining copies of new Literature, use the coupon on page 97.

398—New H & C Price List

Hart & Cooley Manufacturing Co., 61 West Kinzie St., Chicago, Illinois, is distributing to their jobbers a revised price list, effective January 1, 1937, on floor registers, faces, and borders. This price list is accompanied by a letter to their jobbers, announcing a new catalog No. 37 in preparation. There are changes in and additions to the air conditioning line, new features and improvements to the damper regulator sets and parts, and information regarding the price revisions.

◆

399—Solder Products

American Solder and Flux Co., Philadelphia, is distributing a small 16-page—3⅜ by 6⅛ inch—booklet entitled "Solder Products by Solder Specialists," listing each of their products with brief descriptions.

The company specializes in the manufacture of fluxes and welding compounds to meet the requirements of a wide range of metals and working conditions.

They also list an automatic soldering machine for soldering small work and metal cleaning compounds.

◆

400—Rolling Doors and Shutters

Cornell Iron Works, Inc., 3600 Thirteenth St., Long Island City, has just published a new eight-page catalogue of rolling doors and shutters, hand and motor operated, with a description of types, illustrations, and photographs of steel and bronze doors in place.

Full tables of dimensions and clearances are given f automatic closing rolling doors labeled by Underwriters Laboratories, Inc., for fire walls, etc., as well as standard rolling doors.

Copies are free upon request.

◆

401—Thawing Frozen Water Pipes

The Hobart Brothers Company, Box FW-116, Troy, Ohio, has just released a new book on "Thawing Frozen Water Pipes."

The book covers actual cases of pipe thawing—the nature of the job—time required—length of pipe to be opened up—size and kind of pipe—costs, etc. It is a non-technical book compiled for the average man to read and contains complete drawings and diagrams explaining the methods used, the various hook-ups for thawing pipes and many other pages of worthwhile information on the subject.

A copy may be had by writing the company on your letterhead.

◆

402—The Punkah Louvre

Kelvin & Wilfrid O. White Co., 90 State St., Boston, Mass., is distributing a 24-page illustrated catalog covering "The Punkah Louvre," manufactured by Thermotank Limited, Govan, Glasgow, S. W. 1, Scotland.

This booklet described the new Punkah louvre, a new type ventilator in three styles for railway compartments, ocean liner cabins, hotel bedrooms, dining rooms, auditoriums, etc. These three styles differ only in their method of controlling and shutting off the supply of air and each with special features, and in various sizes.

For introducing warm or cold air, diffusors are available which cut down the velocity to about one-tenth of that created by the uninterrupted jet.

The company also makes the new Thermotank air distributor, Torpedo fans and a reversible Torpedo fan.

"We are now arc welding a line of scale pans for meat packers—made of 16 gauge stainless steel. The welds are smoother, free from pores, will take a better polish and they cost 25% less than those produced by the other process.

"We've also got orders for a total of 58 large radiator enclosures for schools—because we were able to produce an arc welded design which is absolutely smooth and round-cornered—safe in the gyms.

"Our Lincoln Welder even does a better and quicker job on many light-gauge parts than our spot welder.

"Mr. Jack Brotherton, shown in the picture, has been welding for 15 years—arc welding for only 9 months. But, try to get him to use anything other than the Lincoln Arc Welder now!

"By all means we have found our Lincoln Welder a profitable investment."

A. H. LUMM, *Gen. Mgr.*
The Lumm Co., Toledo, Ohio

You, too, can bring in new lines of profitable business with this easy-to-operate welder. The cost? As little as $200. Easy terms can be arranged. Ask for details. THE LINCOLN ELECTRIC COMPANY, Dept. EE-319, Cleveland, Ohio. Largest Manufacturers of Arc Welding Equipment in the World.

★ MAIL THIS COUPON TODAY ★

THE LINCOLN ELECTRIC COMPANY
Dept. EE-319, Cleveland, Ohio

Gentlemen: Please send me full particulars on the new $200 Lincoln Welder. I now weld with electric arc ☐ gas ☐.

Firm Name _____

Your Name _____ Title _____

Address _____

City _____ State _____

Mansard Roof

(*Continued from page* 16)

sheets and is carried across the top of the coping and turned down as a drip inside the coping wall. Joints in the molding are soldered and occur at about 8-foot centers.

Dormers

Where the roofing sheets abutt the sides and top of the dormers precautions were taken to get water tightness. Along dormer sides the sheets were carried against the masonry and the space caulked with cement. This cement also fills the space between the dormer masonry and the end of the channel girt. When the sheets were fastened in place the meeting edge with the masonry was coated with asphalt to give further water tightness.

Where the roofing sheets meet the curved top of the dormer the space between girt and masonry and sheet and masonry was caulked with cement and again coated with asphalt. The details show the application and protective measures.

◆ ◆

Barn Ventilation for Tobacco Curing

A short item in the Paris (Kentucky) *Post Intelligencer* by M. F. Williams, recently called attention to the need for proper barn ventilation in the successful curing of tobacco.

The author states that the barn should be extremely tight and provided with proper ventilation. There should be full ridge ventilators in the roof, except the barn that is covered with boards. A system of ventilation should be provided around the bottom in order to cause a rapid passage of air over the surface of the leaf. The weather may be such that it will be necessary to keep the ventilators closed, or it may be necessary that they be left open while the tobacco is coloring. This will depend altogether on the weather, and the grower should be able to make his own weather conditions in the barn if he is to receive top prices for his tobacco.

◆ ◆

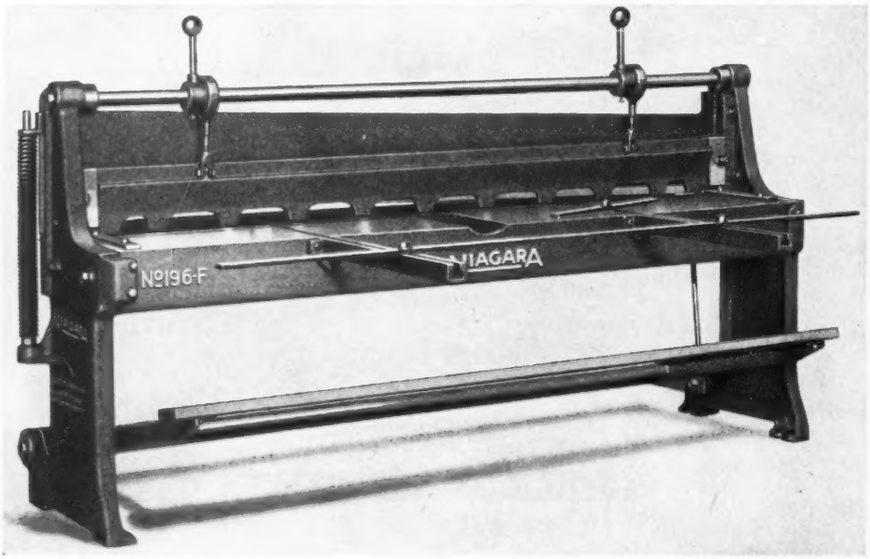
The Material

The resulting change in appearance of the new roof over the old is plainly indicated in the before and after photographs. Even more important than better appearance, however, is the weather tightness and long life expectancy of the new material. In the estimation of the owners, the new roof has also removed a very pressing maintenance cost and danger.

The Robertson protected metal used on this installation is a steel core sheet on which is applied by special process one layer of asphalt, then a layer of asphalt impregnated asbestos felt, another layer of asphalt and a finish coating of copper applied by electro plating. All protecting coating except the finished copper is applied to both sides of the steel core.

The particular sheet used on the Hotel LaSalle is designed especially for mansard roofs. The 33-inch wide sheet is rolled into 2½-inch corrugations spaced 6 inches from center to center. The corrugation is 1 inch high.

Why Hard Boiled Sheet Metal Men LIKE NIAGARA FOOT OPERATED SHEARS



1. No. 18 gage capacity.
2. Cutting length capacity 8 feet.
3. Easy operation.
4. Accurate shearing.
5. Clear visibility of cutting line.
6. Parallel screw adjustable back gage with steel graduated scale.
7. Niagara steel laid knives with alloy steel cutting edge.
8. T slots in bed graduated for setting gages.
9. Bed recessed in center for convenience.
10. Ideal where power is not available.

Write for Bulletins on the complete line of Niagara foot and power shears, with and without gap.

Money Makers for Your Sheet Metal Shop

Folders—Brakes
Groovers—Seamers
Slip Roll Formers
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Shears; Squaring, Rotary
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Wiring, Beading, Burring, Flanging

NIAGARA MACHINE & TOOL WORKS, BUFFALO, NEW YORK

NIAGARA

New Literature . . . .

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403—Minneapolis-Honeywell Sales Helps

Minneapolis-Honeywell Regulator Co., Minneapolis, Minnesota, is preaching the gospel of automatic heat and air conditioning with some 76,000,000 advertising messages in Saturday Evening Post, Collier's, House Beautiful, Nation's Business, Time, American Home, House & Garden, Business Week, New Yorker, and leading newspapers, they advise. They are co-operating with dealers and manufacturers with broadsides and posters, counter and window displays, together with consumer booklets, leaflets and folders.

◆

404—Stok-Rite Automatic Stokers

Chicago Automatic Stoker Co., not inc., 14 North Clinton St., Chicago, Illinois, is distributing a four-page folder illustrating and describing their Stok-Rite automatic coal stoker, which they claim is easily and quickly adaptable to any type of heating plant—steam, hot water, vapor heat, warm air—for buildings from home to six-flat size.

The Stok-Rite system consists of the stoker complete ready for operation, room thermostat, steam pressure control for steam boilers, stack control or low fire control to prevent overheating of the furnace or boiler and to maintain fire at all times, draft control to permit of proper automatic control of stack draft, and limit control which cuts off stoker automatically in any emergency.

The stoker is overfeed "buggy" type to roll from bin to heater, has a ram ejector feed and forced draft.

◆

405—Handbook of Chemistry and Physics

Chemical Rubber Publishing Co., Cleveland, Ohio, has just completed the twenty-first edition of the Handbook of Chemistry and Physics, representing a 23-year accumulation of necessary data for the scientist and engineer, essential in the commercial, educational and research laboratory. The book contains accurate tables, formulas and scientific data. Chas. D. Hodgman is editor-in-chief.

The 21st edition represents an increase of over 175 pages of new composition entailed by complete revision of several important tables. In the Mathematical Section, the numerical table of former editions has been replaced by a new and improved form. It now appears in two parts, the first of which gives the reciprocals and the circumference and the area of circles. The second part is devoted wholly to squares, cubes and roots, and all values are given to at least seven significant figures. The square roots of 10n and the cube roots of 10n are included.

A table of haversines and considerable material on statistics have been added, and the order of arrangement altered so as to place the four and five-place logarithm tables at the front of the volume.

The collection of laboratory arts and recipes has been completely revised and enlarged by material sent in by a large number of contributors in charge of or associated with educational or commercial laboratories.

A revised table of isotopes brings up to date the information in this rapidly changing field.

Increasing convenience in the reduction of gas volume to standard conditions will result from the use of the new special table giving both the factors and their logarithms for such reductions.

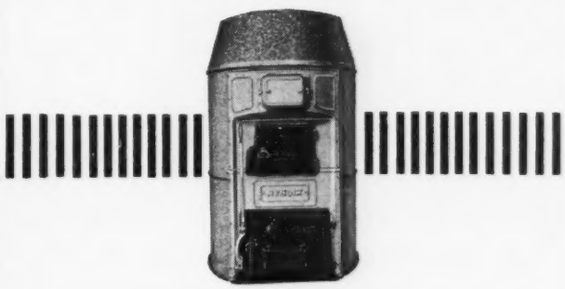
Several small tables have been added.

For convenience the Handbook is divided into five sections: 1. Mathematical Tables; 2. Properties and Physical Constants; 3. General Chemical Tables; 4. Heat, Hygrometry, Sound, Electricity and Light; 5. Quantities and Units —Miscellaneous Tables.

THE

RYBOLT

5 POINT CAST IRON



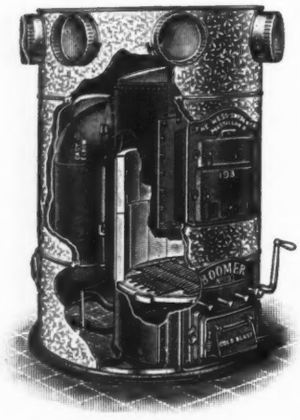
The RYBOLT 5 point cast iron furnace should be included in the line of every up-to-date heating man. In addition to superior features of design and performance, it carries the name and guarantee of a firm that has practically "grown-up" with the trade. We've had over a quarter of a century of quality furnace building at RYBOLT and, as a result, have obtained the good will and confidence of prominent heating men all over the country.

One installation will be enough to convince you that the RYBOLT 5 point cast iron, backed by the RYBOLT name, is the best buy in the warm air heating field. And it'll be easy to sell it—just explain those five points to your prospects: Beauty . . . . . Strength . . . . . Economy . . . . . Price . . . . . Quality . . . . . and the sale is made.

Don't delay . . . . . Write now.

THE RYBOLT HEATER COMPANY

ASHLAND OHIO



Boomer Boiler Plate Furnaces

Also made with duplex grates and upright shaker.

Have been successfully made for 23 years. Where introduced have given satisfactory service. The fire pot liners are the best we can buy and we know of several Boomers that still have the original liners in, which are 23 years old. We have been making cast iron Boomers for 50 years.

If you are interested in selling a strictly high grade furnace, ask for prices and agency.

Nothing but the best of material enters into the making of Boomers.

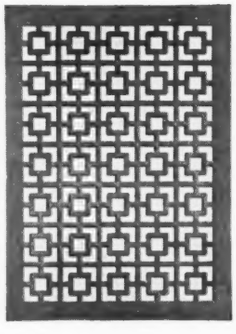
When repairs are needed, avoid risk of dissatisfaction by ordering direct from the original patterns. Prices are low.

We sell to legitimate dealers only.

THE HESS-SNYDER CO., MFRS.
Massillon, Ohio

PERFORATED METALS

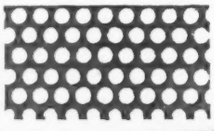
Many designs of Perforated Metal for Architectural Grilles, Radiator Enclosures, Air Conditioners, Cabinets, Safety Guards, and for all screening and sizing operations.



Steel, Stainless Steel, Brass, Bronze, Copper, Monel, Aluminum, Zinc and other metals or materials perforated to your order.

Round holes from .020" to 7". Slot holes from .008" to 3" wide. Square holes of standard sizes. Complete line of brass and tin in small sizes. Prompt Service—Pleasing Prices.

Send us your next specifications.



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The Harrington & King PERFORATING CO.

5649 Fillmore St., Chicago, Ill. New York Office, 114 Liberty St.

New Literature . . . .

For your convenience in obtaining copies of new Literature, use the coupon on page 97.

406—Draft-A-Justor

Preferred Utilities Manufacturing Corp., 33 West 60th St., New York, N. Y., is distributing a four-page folder illustrating and describing their preferred Draft-A-Justor in domestic and commercial sizes, with list prices. All popular sizes of the Draft-A-Justor are equipped with Kwik-Klamp tees.

This company manufactures and distributes automatic heating and air conditioning utilities.

◆

407—Perfex Controls

Perfex Controls Company, Milwaukee, Wisconsin, is distributing two new pieces of literature, one entitled "Accuracy," and the other "Specify Perfex Automatic Controls for Your Stoker."

The first illustrates and describes the Perfex room thermostats, made in two styles—the Super-Sensitive type made for both low voltage and line voltage for heating, cooling and refrigeration; and the Bi-Actuated type made for low voltage and line voltage for heating applications. A heavy duty bellows type is promised. Twin-contacts are an exclusive feature claimed.

The second piece of literature is intended to be hung on the dealer's wall and illustrates, describes and gives specifications for Perfex stoker combustion controls. The company also makes a single pole, single throw transformer relay.

◆

408—Arc Welding Handbook

The Lincoln Electric Company, Cleveland, Ohio, announces a reissue of the "Procedure Handbook of Arc Welding Design and Practice" (Fourth Edition) in greatly enlarged form (819 pages). The handbook is reissued at this time to include all new data essential for most efficient use of arc welding in all its varied applications. Size 5¾ x 9 in.; semi-flexible binding.

New data presented in the Procedure Handbook includes complete information on the following subjects: Characteristics of the Welding Generator; Selection of Type of Joint; Insurance of Fusion Welded Vessels; Welding Codes; Arc Cutting; Polarity of Welding Current; Horizontal Welds; Sheet Metal Welding; Effect of Electrode Size on Welding Cost; Methods of Testing Weld Metals; 4-6 Chrome Steel; Monel Metal; Principles of Surfacing by Welding; Welded Design Begins with Standard Shapes and Plates; Plate Girders.

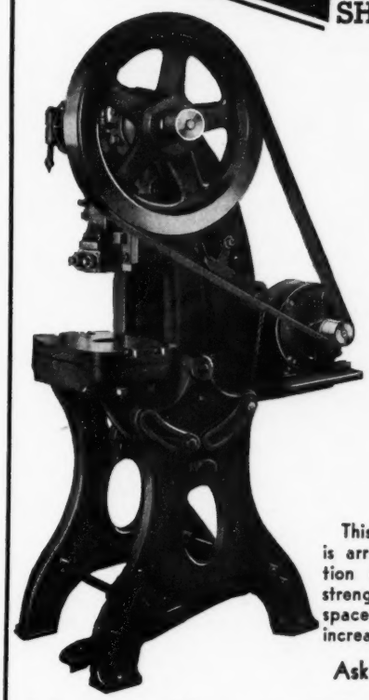
In addition to the new data, the Handbook has been thoroughly revised in all its departments in light of present-day arc welding practice.

Encyclopedic in scope, concisely written and profusely illustrated, the Handbook is a complete reference guide written especially for use of designers, engineers, architects, production managers, welding supervisors and operators.

The eight sections of the book cover: Part I—Welding Methods and Equipment; Part II—Technique of Welding: Part III—Procedure, Speeds and Costs for Welding Mild Steel; Part IV—Structure and Properties of Weld Metal; Part V—Weldability of Metals; Part VI—Designing for Arc Welded Steel Construction of Machinery; Part VII—Designing for Arc Welded Structures; Fundamental Advantages of Arc Welded Design over Riveted Design; Part VIII—Typical Applications of Arc Welding in Manufacturing, Construction and Maintenance. Furnaces and Heating Boilers, Furniture, Gas Plant Equipment, Grave Vaults, Special Tools, Jigs and Fixtures, Cutting Tools and Dies, Machinery and Machine Parts, General Maintenance and Repairs, Ornamental Iron, Pipe, Piping, Pipe Lines (oil, gas, water), Range Boilers, Sheet Metal Work, Tanks, Trucks and Trailers, Summary.

The MARSHALLTOWN *Line*

PRESSES—Capacities from 10 ton to 70 ton.
SHEARS—Capacities 18 gauge to 1/2" plate.



No. 116
THROAT SHEAR
Is especially designed for Cutting Inside Circles and Irregular Shapes.

No. 18
MOTOR POWER THROATLESS SHEAR
Complete with 1/8 HP standard motor, self-feeding and easy to operate.

No. 2
PRESS
This ruggedly constructed Press is arranged with proper distribution of weight giving maximum strength and affording ample die space, low operating cost and increased output.

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HAND POWER THROATLESS SHEAR
For irregular cutting or straight splitting of 18 gauge sheets or lighter. Will cut sheets of any dimensions.

Ask Your Jobber or Write

Marshalltown Manufacturing Co.
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MARSHALLTOWN IOWA U.S.A. MFG. CO.

WHAT DO YOU REQUIRE OF YOUR SOURCE OF SUPPLY?

Ability to get all materials you need.

Quality products which create customer good will.

Fair prices, which are uniform to all.

Prompt, courteous service and deliveries.

Is your goal bigger profits in the sheet metal, roofing or furnace installation business? Then consider the real value which each of these points has for you.

Osborn service . . . on thousands of items . . . is responsible not only for our own success, it is also an important factor in the success of thousands of our customers. Because this is true, we pledge ourselves to you to continue earnestly to improve upon it.

Whether your needs are large or small, we are always glad to serve you.

A DEPENDABLE SOURCE OF SUPPLY FOR 78 YEARS

PRIME METAL SHEETS • EAVES TROUGH, GUTTER, ETC.
ROOFING, PAINT, SUPPLIES • SHEET METAL TOOLS
WARM AIR FURNACES • WINTER AIR CONDITIONING SYSTEMS

THE J. M. & L. A.
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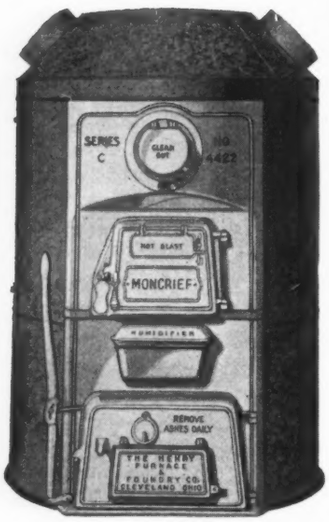
Manufacturers—Distributors
BUFFALO—CLEVELAND—DETROIT
Metals and Metal Products

MONCRIEF



SAVES YOU MONEY OUT ON THE JOB

The careful workmanship, the accurate fit of all parts of a Moncrief Furnace or Air Conditioning Unit, are revealed when you erect it in your customer's basement. Every Moncrief is mounted, marked and shipped to you as an assembled unit. Dealers repeatedly tell us that much less time is required to set up a Moncrief. The Moncrief way thus saves you time and money and contributes to the satisfaction of the owner with the job. *Send for catalogs and prices.*

THE HENRY FURNACE & FOUNDRY CO.
3473 E. 49th St., Cleveland, Ohio

Manufacturer of

- CAST and STEEL FURNACES
- AIR CONDITIONING SYSTEMS FOR GAS, OIL and COAL
- PIPE, FITTINGS and ACCESSORIES
- MONCRIEF BLOWER-FILTER UNITS
- MONCRIEF AUTOMATIC HUMIDIFIERS
- MILES JUNIOR AIR CONDITIONERS

New Literature . . . .

For your convenience in obtaining copies of new Literature, use the coupon on page 97.

409—Barnes Handy Reference Catalog

Barnes Metal Products Co., 4425 W. 16th St., Chicago, Illinois, is distributing Handy Reference Catalog No. 136, with information and standard list prices of Barnes conductor pipe, elbows, eaves trough and fittings, of various sizes and metals.

◆

410—Autovent Products

Autovent Fan & Blower Co., 1805 No. Kostner Avenue, Chicago, Illinois, is distributing an envelope stuffer picturing and describing Autovent products—Autovent "31 Series" fan, the Coolvent, unit heaters (electric and steam), "BW" Bucket Wheel Propeller Fan, cabinet ventilator, Uniblade blowers, and automatic louvres.

◆

411—A Visual Report of Progress

The New Jersey Zinc Company, 160 Front Street, New York City, has recently published a "Supplement to a Visual Report of Progress," representing the astounding progress which has been made in the die casting industry since the publication of the original "A Visual Report of Progress" last year.

This booklet will enable readers to see zinc alloy die castings in picture book form. Copies will be sent to all those requesting a copy on their company letterhead.

◆

412—Furblo Winter Profit Program

Furblo Company, Hermansville, Michigan, is calling dealers' attention to their Winter Profit Program—inviting them to go places with winter—to tie in with a program that for the past two years has taken the slack out of the slack season and has made the winter a profit season for the warm air heating contractor who stays awake.

The 1936-37 Furblo Winter Profit Program, they say, is a six-fold program with Institute Bulletins, Window Displays, Sales Helps, Advertising Helps, Newspaper Ad Service.

◆

413—Dust Control Equipment

The American Foundry Equipment Company, Mishawaka, Indiana, is distributing copies of the second of the articles by C. A. Snyder, Dust Control Engineer, on "How to Install Dust Control Exhaust Piping."

How hoods should be constructed, run of piping, changes in pipe sizes, elbows, blast gates, recommended gages, and joints, are subjects discussed.

Information on dust control is given in American Dustube Dust Control Book, offered upon request.

◆

414—Forced Circulating Unit

Buffalo Forge Company, Buffalo, New York, is distributing Bulletin No. 3044, entitled "Buffalo Type H. V. A. Forced Circulating Unit." H. V. A. fans are now available with a new one-piece motor mounting and motor for quick installation. The fan proper is the same. Quiet operation is assured at the speed recommended. Bearings are floated on rubber insulators, completely isolating the rotating parts from the housing. With the use of the recommended canvas connection from fan outlet to the duct, operating noises are reduced to an absolute minimum, they say.

The bracket for mounting the motor is rigid and will not vibrate. V-belt drive provides adequate driving surface, with close pulley centers. Motors are resilient mounted.

List prices are given for Sizes 121 and 151.

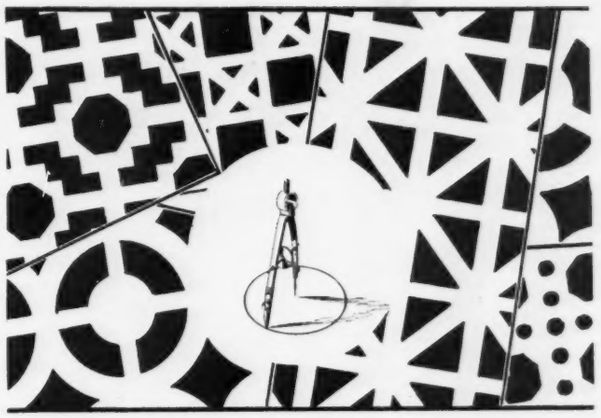
NU DRY FURNACE CEMENT

NU DRY furnace cement is the ideal for those fall and winter furnace setting jobs. It can be applied easily and the furnace man knows that he can depend on it for excellent service. The following features make NuDRY supreme among furnace cements.

- Will not crack, bloat or powder when furnace is fired immediately after applying.
- Will not shrink.
- Keeps joints tight at all times.
- Withstands high temperatures.

Write today for further information.

PYROLITE PRODUCTS CO.
Refractory Engineers
1221-31 W. 74TH ST. CLEVELAND, OHIO



DESIGNS . . . *Planned Scientifically*

Wissco Perforated Metal designs are not only attractive but extremely practical. They are scientifically planned to give a minimum obstruction to air passage and maximum concealment.

Send for this folder showing a variety of patterns.

WICKWIRE SPENCER STEEL COMPANY
41 East 42nd Street, New York
Buffalo Worcester Chicago San Francisco

WICKWIRE SPENCER perforated metals

LIFE TIME HAMMERS

Head and handle forged of one-piece tool steel—I-beam construction—head can't come off—handle can't splinter. Made under Estwing Patent No. Re-16820.

Perfect Grip

18 oz. Setting

Whitney Tools popular everywhere. No. 2 Punch, illustrated, sturdy, easy to operate, long life—length 23 in. Capacity 1/16-in. hole through 1/4-in. iron. Punches and dies in sizes from 1/32 to 1/2 in. by 64ths.

Ask Your Jobber

W. A. WHITNEY MFG. CO.
636 RACE ST. ROCKFORD, ILL.

SIMPLE TRUTHS ARE ENDURING

When I was a little shaver running around my grandfather's furnace shop, he used to tell me, "Boy, if you build an honest product and sell it honestly, you'll never have to worry about keeping customers. Even if you have to charge a little more for good workmanship, your customers will remember quality long after they forget price."

That was a mighty good policy 79 years ago and it's good today. It's like the constitution—a little old-fashioned, but still reliable.

H. P. Mueller, Pres.

L. J. MUELLER FURNACE COMPANY
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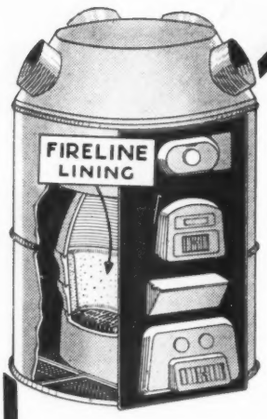
MUELLER-MILWAUKEE



Keep Busy this winter . . . ALL WINTER

With Fireline you don't have to wait for repair work or emergency calls. Right down any street every house is waiting to buy Fireline for every homeowner is seriously interested in:

(1st) cutting his coal bill, (2nd) getting more heat from his heating plant, (3rd) eliminating smoke and soot—in reducing ashes to *all* ashes, (4th) in protecting his firepot against burning out.

Just get this story to your neighbors and you'll be busy all winter for each installation sells others. Start now—Write for free circulars to mail out, instruction sheets and FREE SAMPLE. (If you're too busy to write just pin this ad to your letterhead.)

FREE SAMPLE **Fireline Stove & Furnace Lining Co.**
1866-L Kingsbury St. CHICAGO, U.S.A.

FIRELINE

THE HOTEL of THE MONTH

Terre Haute House
TERRE HAUTE INDIANA

ALBERT PICK HOTELS

You'll get more for your money at Pick Hotels. Spacious, comfortable rooms. Delicious food and real personal service. All at moderate prices.

GREAT NORTHERN HOTEL ..... CHICAGO, ILL.
MIAMI HOTEL ..... DAYTON, OHIO
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FORT MEIGS HOTEL ..... TOLEDO, OHIO
FOUNTAIN SQUARE HOTEL . CINCINNATI, OHIO
BELDEN HOTEL . (Opens in Dec.) . CANTON, OHIO
ANTLERS HOTEL .... INDIANAPOLIS, INDIANA
ANDERSON HOTEL ..... ANDERSON, INDIANA
TERRE HAUTE HOUSE . TERRE HAUTE, INDIANA
VENTURA HOTEL ..... ASHLAND, KENTUCKY
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NEW SOUTHERN HOTEL . JACKSON, TENNESSEE
MARK TWAIN HOTEL ..... ST. LOUIS, MO.
RALEIGH HOTEL ..... WACO, TEXAS

PICK HOTELS

THE WORD PICK SHOULD ALWAYS REMIND YOU OF ALBERT PICK HOTELS

New Literature . . . .

For your convenience in obtaining copies of new Literature, use the coupon on page 97.

415—The Wisconsin Humidifier

Wisconsin Humidifier Company, Milwaukee, Wisconsin, is distributing an envelope stuffer entitled "Humidity Protects Your Family's Health." The Wisconsin Humidifier, entirely automatic, is described.

◆

416—Sales Help

American Nickeloid Company, Peru, Illinois, is distributing a little "Key" folder, entitled "The Key to More Sales and Bigger Profits." The "Key" inserted is cut from one of their bright metals. Text sets forth advantages.

◆

417—Rex Air-Pak

Air Controls, Inc., Division of The Cleveland Heater Co., 1933 West 114th St., Cleveland, Ohio, is distributing a leaflet entitled "The Correct Solution to the Conversion Problem." The Rex Air-Pak is described.

◆

418—Largest A. C. Plant

The International Nickel Company, Inc., 67 Wall Street, New York City, prints a story entitled the "World's Largest Air Conditioning Plant Is on the Air" in the fall edition of INCO, No. 2 of Vol. XIV. It is in New York's Radio City, and provides refrigeration equivalent to that of the entire summer ice consumption of Dallas, Tex.

◆

419—Crise Draft Regulator

The Crise Electric Manufacturing Co., Mount Vernon, Ohio, is distributing a folder describing the Crise floating draft control system. A grid coil, no larger than a thimble, connected to the Crise single contact thermostat, stops and starts the motor in either direction with the almost immeasurable temperature change of one-one-hundredth part of a degree.

◆

420—Nu-Dry Furnace Cement

The Pyrolite Products Co., 1221 W. 74th St., Cleveland, Ohio, is distributing an envelope stuffer giving facts and advantages of Nu-Dry furnace cement. Nu-Dry is said to be a combination of highly refractory materials. It is supplied dry, ready to be mixed with water and is compounded so that when the furnace is fired the action of the heat effects an immediate bond between the castings and is maintained without cracking, crumbling, bloating or shrinking.

◆

421—Enduro Stainless Steel

Republic Steel Corporation, Republic Building, Cleveland, Ohio, has recently released five of a series of booklets on Enduro Stainless Steel. Cover illustrations are reproductions of photographs of various mill operations in the production of Enduro. Layout and typographical treatment differ radically.

First in the series is a booklet of general nature, explaining the reasons for the amazing rise in popularity of stainless steel and illustrating many of the more important applications of Enduro.

A second book features detailed data on Enduro 18-8 and its several variations. The third booklet is devoted to the straight-chromium types of Enduro—AA, S, S-1 and FC. The fourth booklet contains information on the heat-resisting types of Enduro—HCN, HC and NC-3. The fifth booklet treats Enduro 4-6 percent Chromium Steels. These latter steels are not stainless but are intermediate between ordinary carbon and stainless steels.

New Literature . . . .

For your convenience in obtaining copies of new Literature, use the coupon on page 97.

422—Janitrol Sales Engineering Handbook

Surface Combustion Corporation, Toledo, Ohio, announces the Janitrol Sales Engineering Handbook, the purpose of which is to correlate and present, in a simple and convenient manner, information on the subject of heating buildings with gas fuel. Results of field experience with gas companies and heating contractors, and laboratory research have been condensed into easily understandable methods to assist the gas heating engineer in analyzing, planning, and producing successful heating installations with a minimum of effort and a sufficient degree of accuracy.

There are chapters on the principles of heating, the development of heating systems, fuels, heat requirements of buildings, humidity, the gravity warm air heating system, the mechanical warm air heating system, the application of blower-filter unit to existing gravity warm air heating system, the steam heating system, the hot water heating system, conversion burners, the unit heating system, venting and gas heating equipment, Janitrol products, automatic control equipment, and finally specifications for Janitrol conditioners and gravity heaters, conversion burners, unit heaters, and accessories. The final chapter is on the operation of gas heating equipment and a glossary of heating terms concludes the book.

The book is not free but is sold for a nominal price.

◆

423—Bronze Bearing Catalog

Randall Graphite Products Corporation, 609 West Lake Street, Chicago, Illinois, has just issued a new catalogue of graphite bronze bearings with a marginal thumb index of standard sizes.

The catalogue lists inside and outside diameters and lengths of all standard bronze graphite bushings and sheave bearings. The inside diameters are shown in the marginal index for quick reference.

The catalogue also gives figures on inside diameter reductions for press fitted bearings. Also briefly described are the new Randall reservoir graphite bronze bushings and thrust washers, together with illustrations of Randall pillow blocks.

◆

424—Is Your Home a Desert?

The J. L. Skuttle Company, 4290 West Fort Street, Detroit, Michigan, is distributing a new folder entitled "Is Your Home a Desert?" illustrating and describing the new Skuttle gas-fired humidifier for radiator-heated homes.

The new Skuttle gas-fired humidifier may be installed either with or without a humidistat for automatically regulating the rate of humidification. When operated with the humidisat, the unit operates to supply only the exact amount of moisture needed to maintain the desired degree of humidity.

With the exception of a small 6½x14¼-in. grille for introducing moisture into the living quarters, the unit is installed in the basement and is entirely out of sight. Installation consists only of providing a floor opening for the grille, suspending the unit beneath the floor and making necessary water, gas and flue connections. The grille, preferably located in a centrally located first floor room, rapidly diffuses the moisture to all parts of the home, regardless of how distant.

◆

425—Premier Furnace and Boiler Cleaner

Electric Vacuum Cleaner Co., Inc., 1734 Ivanhoe Rd., Cleveland, Ohio, illustrates and describes the new Premier furnace and boiler cleaner in a new folder. There are four models, two powered by a ½ h. p. and two by a 1 h. p. motor, designed for the needs of the coal dealer, the oil burner man, the heating or furnace man, or stoker service companies.

FOR YOUR CONVENIENCE

American Artisan, 6 N. Michigan Ave., Chicago, Ill.

Please ask the manufacturer to send me more information about the equipment mentioned under the following reference numbers in "New Products" and "New Literature." (Circle numbers in which you are interested):

148	149	150	151	152	153	154
155	156	157	158	159	160	161
162	163	164	165	166	167	168
169	170	171	172	173	174	175
176	177					
398	399	400	401	402	403	404
405	406	407	408	409	410	411
412	413	414	415	416	417	418
419	420	421	422	423	424	425

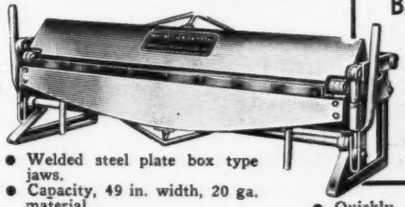
Name ..... Title .....

Company .....

Address .....

Are you Manufacturer——Jobber——Dealer——

Whitney JENSEN *Portable* BRAKE



- Welded steel plate box type jaws.
- Capacity, 49 in. width, 20 ga. material.
- Weight, only **265 lbs.**
- Can be carried easily by two men.
- Self-locking clamping handles.

"Air Conditioning Special"

BENCH TYPE

Two Models

The Bench Type can be quickly converted to a Floor Type machine by the addition of a sub-base held with 4 bolts.

- Quickly adjustable for different gauges.
- Has every feature of a standard brake.

IMPERIAL ROLLER BEARING PUNCHES. Offered in 3 sizes. Will work inside 90 degrees. Quick changing for punches and dies. No cams to wear. Stripping positive.

RIVET PUNCHES & DIES. We can supply a complete assortment of rivet punches and dies from stock.

Good tools are essential to a profitable business. Make it a habit to use Whitney tools and to consult us on any tool problem.

WHITNEY METAL TOOL CO.

91 FORBES STREET

ROCKFORD, ILLINOIS

METZNER

for

FURNACE REPAIR PARTS

We can fill your order for almost any part right from our completely stocked warehouse. What we can't supply we'll get for you in a hurry. You can always save money and time when you send your order for repair parts to METZNER.

The service is fast and OUR REPAIRS FIT.

METZNER STOVE REPAIR CO.

KANSAS CITY Established 1880 MISSOURI

Skylight Construction

(*Continued from page 22*)

at C and D of Fig. 18 and 15 inches apart, then $17 \times 1.2 = 20.4$ for bar C. To obtain length of bar D add 15 and 17 and obtain 32. $32 \times 1.2 = 38.4$ for jack bar D. When the spacing of the jack bars is unequal, simply add the various spaces to obtain the *plan* lengths and then multiply by 1.2, the factor for the common and jack bars.

Estimating Quantities

The amount of material required for fabricating a hipped skylight with ridge ventilator as shown in Fig. 16, will now be computed. The length of the skylight curb is $98 + 42 + 98 + 42 = 280$ linear inches. The amount of girth for the skylight curb measures 7 inches. $7 \times 280 = 1{,}960$ square inches. The length of the vent-curb with its laps and projections is $64 + 8 + 64 + 8 = 144$ linear inches. Its girth is 5 inches. $5 \times 144 = 720$ sq. in. The length of the vent-body with laps and projections is the same as the vent-curb. The girth of the vent-body is 3.5 in. $3.5 \times 144 = 504$ sq. in.

The length of the hood including its projections and laps is $67 + 9 + 67 + 9 = 152$ linear inches.

The half girth of the full hood is 5.5 inches. $5.5 \times 152 = 836$ square inches.

Four bar braces will be required on the inside of vent-curb. Each brace will have a girth of 1½ in. by 6 in. long. $6 \times 1.5 = 9$ sq. in.

Four hood braces will be used inside of ventilator hood. Each brace is 9 in. long by 1½ in. girth. $9 \times 1.5 = 14$ sq. in.

There are 8 common bars each 22.5 inches long including laps. $8 \times 22.5 = 180$ linear inches.

The girth of the common bar, including its capping, is 8 inches. $8 \times 180 = 1{,}440$ sq. in.

There are 8 jack bars each 18 in. long, including laps. Its girth is the same as the common bar, or 8 inches. $8 \times 18 \times 8 = 1{,}152$ sq. in.

There are 4 hip bars each 29 inches long with laps. $4 \times 29 = 116$ linear inches. The girth of the hip bar with capping is 8 inches. $8 \times 116 = 928$ sq. in.

We then have

1,960 sq. in. for skylight curb.
720 sq. in. for vent-curb.
504 sq. in. for vent-body.
836 sq. in. for hood.
9 sq. in. for bar braces.
14 sq. in. for hood braces.
1,440 sq. in. for common bars.
1,152 sq. in. for jack bars.
928 sq. in. for hip bars.

7,563 sq. in.

$7{,}563 \div 144 = 52.5$ sq. ft.

Material Weights

Assuming that 18 oz. cold rolled copper will be used, then

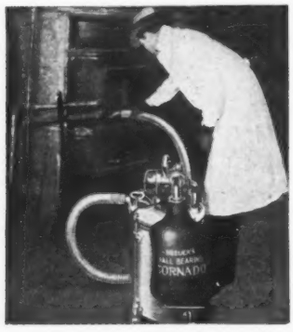
$18 \times 52.5 = 945$ oz. $\div 16 = 60$ lbs.

If a number 22-gauge galvanized copper steel is used which weighs 1.25 lbs. per square foot, then

$52.5 \times 1.25 = 66$ lbs.

Also figure three pounds solder, one-half pound of copper or galvanized iron rivets, 12 number 14 round head brass wood screws with lead washers, to secure the metal curb to roof curb, and 32 round head $\frac{3}{16}$-in. brass bolts and nuts to secure capping to skylight bars.

YOU CAN DOUBLE YOUR BUSINESS THIS WINTER WITH The TORNADO Furnace Cleaner

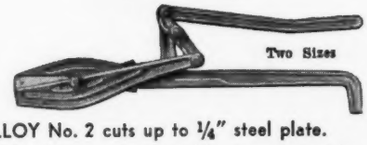


The TORNADO gets you into the basement where it is easy to sell repairs and new furnaces. And you make a profit on the cleaning job too!

The TORNADO is the most powerful furnace cleaner built. Leads the field! Low price—easy payments—free trial. Approved by Anthracite Institute and Underwriters Lab. Thousands in use. Write now for complete information.

Breuer Electric Mfg. Co.
865 Blackhawk Street, Chicago, Ill.

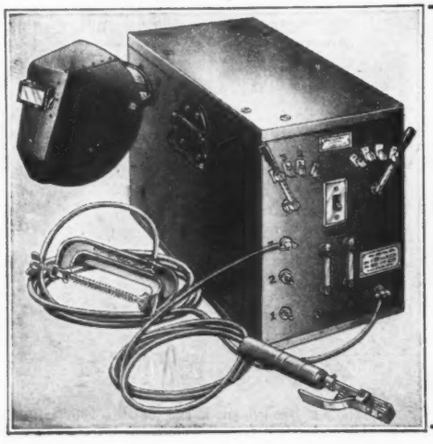
PORTABLE SHEARS
ALL-ALLOY



ALL-ALLOY No. 2 cuts up to ¼" steel plate.
ALL-ALLOY No. 1 cuts up to No. 11 gauge strip or sheet.
Special blades may be had for shearing stainless steel.

FULLY GUARANTEED

BREMIL MFG. CO. Erie, Pa.



GO AFTER *ANY* JOB with the
No. 300 VULCAN ELECTRIC ARC WELDER
BUILT FOR THE SHEET METAL FIELD

The VULCAN portable welder is a strong, substantial welding machine especially suited for sheet metal men who do welding on the job. Will operate off a 110 or 220 AC volt line.

Air conditioning furnace installations and ornamental and structural iron jobs can be done much faster and cheaper with a VULCAN, as it will weld steel, cast-iron, or anything that can be electrically welded. Take it right to the job and put it to work.

Equipment includes fifteen feet of welding cable with terminal and welding rod holder. Twelve feet of ground cable and one Helmet type eye shield. The No. 300 VULCAN portable arc welder should be in every sheet metal shop . . . . . and we've priced it low enough so that you can afford it.

Complete with all equipment—$147.50

Write NOW for details.

VULCAN ARC WELDER MFG. CO. 2636 OLIVE STREET ST. LOUIS, MO.

IRONSET

the Furnace *and* Retort Cement

THAT IS

GUARANTEED

Not to crack, bloat, shrink or blister

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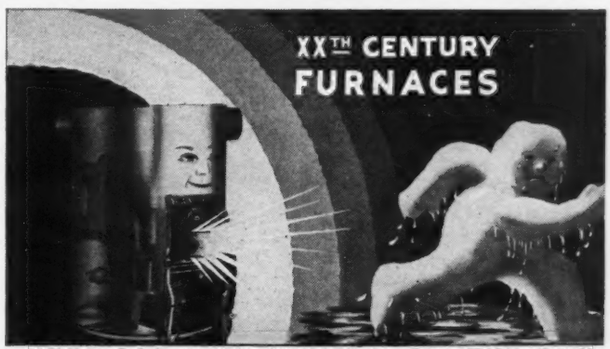

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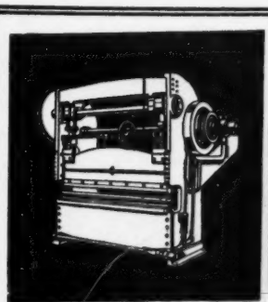

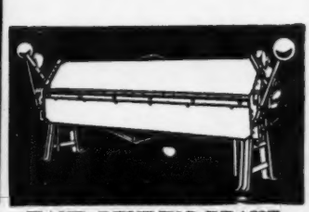

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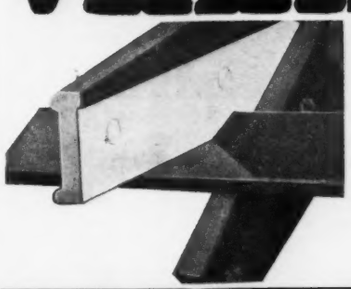

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THE NATIONAL FOUNDRY & FURNACE CO.

DAYTON, OHIO

Welding of Restaurant Equipment

(*Continued from page* 18)

13,000 pounds for tension, by 11,300 pounds for shear, by 15,000 pounds for compression. These values may also be increased by 20% to 30% if welded by the shielded arc process.

Location of Welds

The location of the welds in relation to the parts joined in many cases have an effect on the strength of the welded joint. Repeated tests reveal that when other factors are equal welds having their linear dimensions transverse to the lines of stress are approximately 30% stronger than welds having their linear dimensions parallel to the lines of stress. See Fig. 2—weld A is approximately 30% stronger than weld B.

If the load on the welds is to be distributed equally the welds should be located so as to take account of the shape of the section joined. In Fig. 3, for a problem, let us assume we want this member to carry a load of 7,000 pounds on the line of stress. Being an angle iron the line stress is not in the center of the webb, therefore we have an eccentric or turning effect on our weld. If we put a weld at the toe and one at the heel equal to 3,500 pounds each we have our 7,000 pounds, but our weld at the heel will fail owing to the aforesaid eccentric load. Upon computation we find we need 5/7 or 5,000 pounds at the heel and 2/7 or 2,000 pounds at the toe.

Using Chart

To calculate the length of the welds from the above chart, a fillet weld 3/16-inch through the throat has a safe, allowable load of 1,500 pounds, per linear inch, therefore to obtain a 5,000 pound resistance we need a weld $3/16 \times 3\,1/3$ inches long and for 2,000 pounds a weld $3/16 \times 1\,1/3$ inches long.

In Fig. 4 a single weld at A or B is not as effective in resisting a turning effect as 4 small welds—1, 2, 3, 4, even though A or B has more weld metal than 1 to 4 combined.

If possible welded joints should be designed to minimize bend or prying at the joint. Symmetrical joints are the most desirable as they are stronger than non-symmetrical joints. Stresses in a weld having its linear dimension approximately parallel to the lines of force is not evenly distributed. Under many load conditions the stress is greater at the ends of the welds than in the middle. It is therefore advisable under certain conditions to hook the weld around the corner as shown in Fig. 5. This method of finishing the weld offers greater resistance to tearing action, especially if the weld is subjected to eccentric loads.

These problems of stresses in welded connections are frequently neglected by the assembler. A thorough understanding of weld stresses, however, can obviously result in smaller or fewer welded joints where stress is not high, or may save future trouble by insuring sufficient strength where strength is required.

Laboratory and engineering data for this article was supplied the author by the Lincoln Electric Company.

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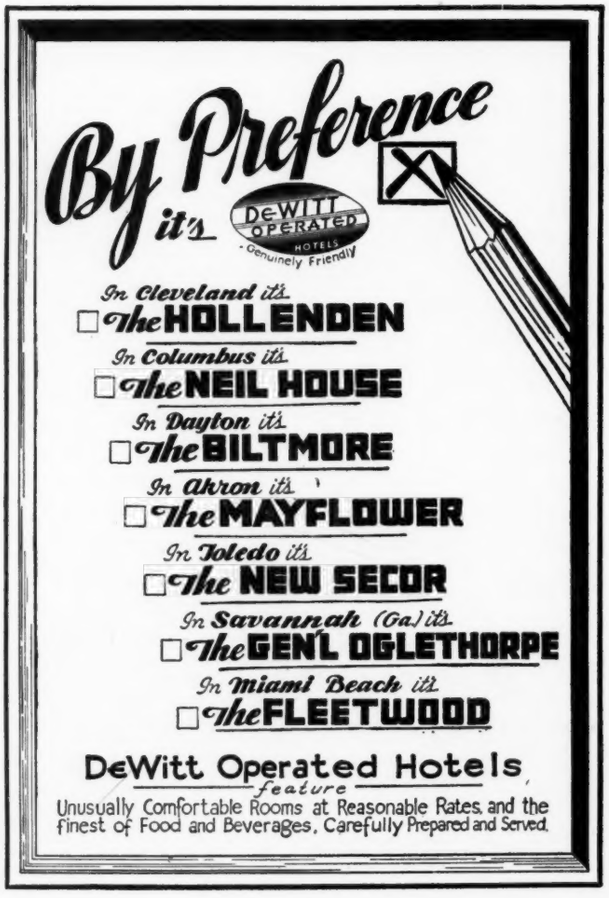

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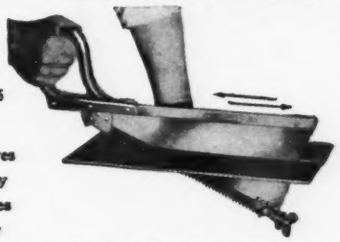

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WANTED—Radiator repair man and shop sheet metal worker. Write Noble Sheet Metal Works, Rhinelander, Wis.

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WANTED: Position by experienced furnace salesman with reliable manufacturer, calling on dealers. Have sold steel and cast furnaces. Have had fan engineering experience and member A. S. H. & V. E. College graduate. Address R. R. Wallace, 1314 Jackson Blvd., Chicago, Ill.

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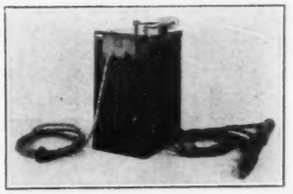

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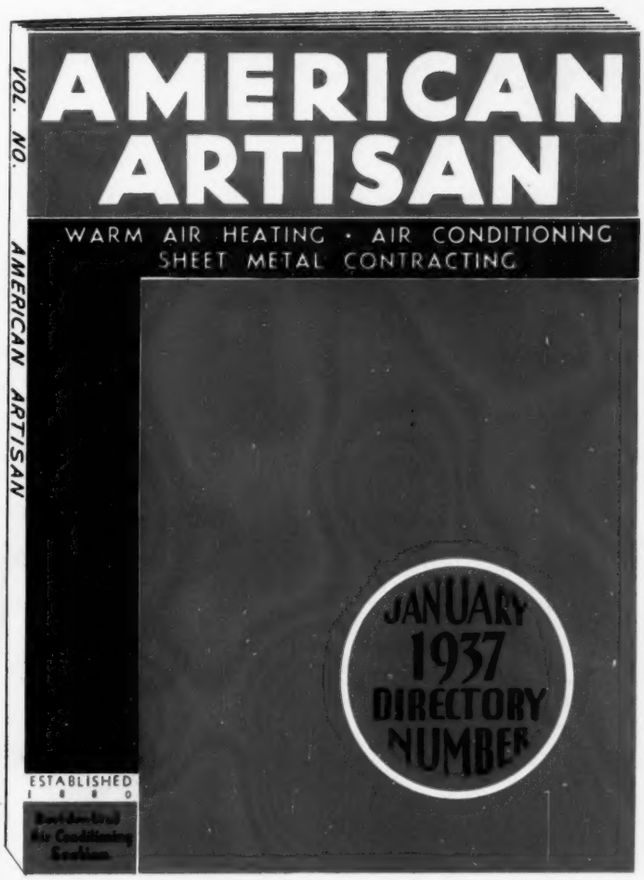

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Answering Every Buying Need

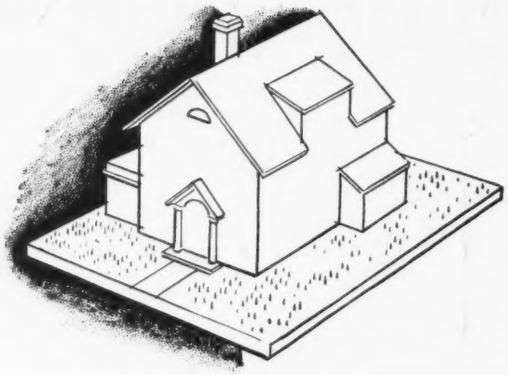
To Our Readers:

Again, in January, AMERICAN ARTISAN will bring you a brand new ANNUAL DIRECTORY of warm air heating, air conditioning, and sheet metal equipment. This 1937 edition —the FIFTH in line—will be the most complete and convenient guide to buying and specifying you have yet had. Its listings of products, their trade names, and the names and addresses of the manufacturers will be all-inclusive and up-to-the-minute. It will contain a considerably increased fund of supplemental product information provided by manufacturers through their advertising. All listings will be carefully indexed and cross-indexed for the speediest possible reference. It will, in short, be designed to answer your every need for buying information during the next twelve months.

Watch for this January number. Besides the DIRECTORY SECTION, it will carry its regular, full quota of outstanding articles on important phases of warm air heating, air conditioning, and sheet metal work. It will come bound in a special, extra-heavy cover to withstand the wear and tear of 365-day handling.

To Our Advertisers:

The January issue will be the largest, most widely distributed, most used issue in AMERICAN ARTISAN'S entire 56-year history. A record number of manufacturers will use space to SHOW and DESCRIBE the products we LIST for them in the DIRECTORY SECTION. You still have time to arrange for a similar tie-up with your listings, if you have not already done so. Write or wire immediately for complete information. SPACE RATES ARE THE SAME AS FOR ANY OTHER ISSUE.



EVEN IN LOW-COST HOUSES DEMAND CALLS FOR COPPER

More and more people are getting educated to demand Copper for roofing, flashing, gutters, leaders, cornices, skylights and other items which the sheet metal contractor must supply.

The clippings here reproduced from "Good Housekeeping" are taken from specifications of a house built to cost less than $7000.

The sheet metal contractor who recommends and uses Revere Sheet Copper and Revere Leadtex (lead-coated copper) goes *with the tide.*

These small jobs, well done, lead to larger contracts, bigger profits and a solid reputation for high-grade work.

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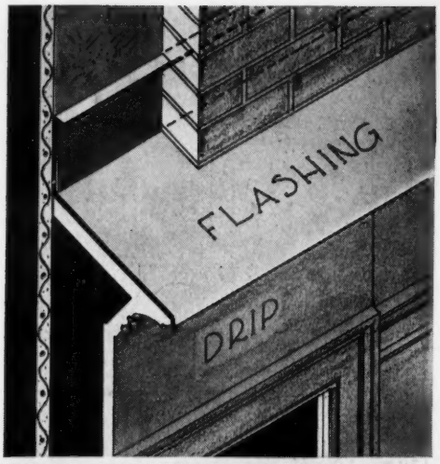
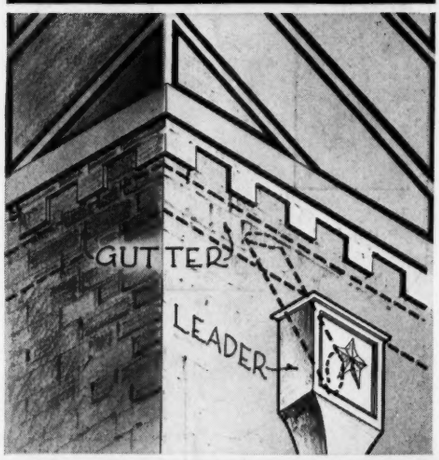


FLASHING OVER DOOR ENTRANCE: The projecting woodwork forming the head of the doorway is made weather-tight by flashing with lead-coated copper sheets. The copper is carried up and back of the walls and bent into one of the joints. The front edge is turned down over the fillet of the wood cornice, doubled-back on itself to form a drip, and then nailed with hard copper nails.



CORNICE: The main cornice has the brick dentils formed by projecting every other brick ½-inch from the face of the wall. The top of the cornice is covered with lead-coated copper sheets, the front edges being turned down over a wood facia board to form a drip. At the back of the cornice is a copper-lined gutter around the four sides of the house. Drainage is through copper conductor pipes to leader heads.

Courtesy of "Good Housekeeping"

Revere Copper *and* Brass

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